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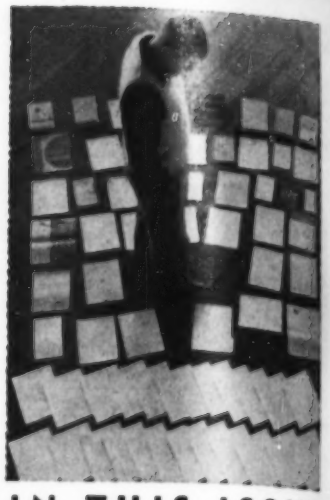

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Utility executives study these reports and pamphlets to find out why they're utility executives. For details see page 39.

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Thermally Thinking

SPOT NEWS AND COMMENT ON GAS INDUSTRY AFFAIRS

Highlighting the News

Tidelands case in hearing

The Supreme Court was to hold a hearing Feb. 1 for decision on whether it would consider the tidelands case. Alabama and Rhode Island had filed suits against California, Florida, Louisiana, and Texas to test the validity of the tidelands law.

Phillips case also admitted to high court

The Supreme Court reversed itself Jan. 18 by granting petitions for rehearing of the famous Phillips case. Certiorari in the case had been denied Nov. 30. Phillips, the FPC, Texas, Oklahoma, and New Mexico will be permitted to argue the case, and six other states may file supporting briefs, but INGAA, IPAA, and two producers' associations were denied the right to file amicus curiae briefs.

For better gas service, $55 per customer

Natural gas utilities in western Pennsylvania, serving more than 950,000 consumers, will spend $52,256,300 in 1954 to improve and extend service. Half of this will go for more transmission lines and storage facilities, according to the Pennsylvania Natural Gas Men's Assn. This will be the eighth consecutive record-breaking year.

GAMA thinks 1954 can be better than 1953

Despite an anticipated decline of 5% in gross national product, and appliance manufacturers' consensus that sales will taper off by small margins, GAMA believes the reawakening within the gas industry to the need for aggressive merchandising can reverse the trend. GAMA's latest general business outlook survey shows that while range and water heater manufacturers expect industrywide output to drop 3.8% and 9% respectively from 1953, most individual companies expect *their own* production to be up, so that results might easily show overall increases.

Heating equipment shipments are expected to remain fairly stable, but clothes dryer manufacturers look for a 41% jump and incinerator builders are the most optimistic of all. Their 1954 prediction: shipments will double.

Crude oil line construction to dip

President Robert Thomas of the Pipe Line Contractors Assn. foresees a 20% drop in line building this year, but practically all of the slack will come in crude oil line extensions. Gasline work will hold close to the 1953 mark, he predicts.

ConEdison gives bonus pay to long-time employees

The New York utility's new CIO contract awarding 7½-cent-per-hour wage increases, with two 5-cent wage progression boosts, gives a special recognition to old-timers. Upon completion of 25 years, an employee automatically is given an extra 5-cent jump in pay. With 12,500 25-year folk on the payrolls, the bonus will constitute a sizeable piece of cash. ConEd thinks this is a "first" in the industry.

Peoples Gas extends heating service to 17,000

Completion of Texas Illinois pipeline facilities has opened the gates for 17,000 more househeating customers in Chicago. Total customers in this class now total 157,000, as against 30,000 in July of 1946. But 97,000 are still on the waiting lists.

An Eye on the Capital

Cost-of-money formula to be scrutinized again

Washington observers were convinced that one of the most far-reaching Supreme Court decisions—if one of the least-publicized in the popular press in recent years—was that in which the court refused, early in January, to grant an appeal for hearing of the original Federal Power Commission order which had cut a request of Northern Natural Gas Co. for a rate increase of $9.3 million.

The court's refusal means, in effect, that the FPC has a new opportunity to clarify its views on the rate of return. As a result, regulatory commissions in all sections which have been following the FPC lead on the cost-of-money theory may be influenced by any new approach FPC may take.

What the Supreme Court did—and its members likely realized what they were doing—was to reinstate the opinion of Judge Woodrough (Eighth United States Circuit Court of Appeals) as the final case law on regulatory methods. If Judge Woodrough's reasoning *is* followed by FPC, that agency is likely to liberalize its original order in the Northern Natural case.

While wire service reports on the case simply noted that the FPC had been upheld by the Supreme Court in an order increasing the Northern Natural Gas Co.'s rates, as affirmed in the lower court, actually there were *three* appeals from the lower court's decisions, all of which were denied. These were:

1. The appeal of the Kansas commission, principally because the FPC refused to allow statutory minimum field

Thermally Thinking

gas prices on gas produced by the company;

2. The appeal of the company, because of a number of other unfavorable FPC rulings upheld by the lower court; and

3. The appeal of the FPC itself, because of the lower court's criticism of the commission's 5½% rate of return computed on cost of money.

This means, in essence, that the case now must go back to FPC for further consideration of its rate of return allowance, in the light of the lower court's opinion. As will be recalled, the Eighth U. S. Court of Appeals criticized the amount of return, suggesting a 6% return instead of the 5½% allowed, and also criticized the narrow comparative cost-of-money basis used by the FPC.

Since the FPC now is under new management, so to speak, and Chairman Jerome Kuykendall has expressed the need of reassuring investors in the natural gas industry and the desirability of shying from any cramping ratemaking formulas, it is probable that the new FPC decision, when it comes, will be far different from the old one.

The FPC members are as much up in the air as anyone else over the 10th U. S. Circuit Court of Appeals' decision in the Colorado Interstate Gas Co. case, in which the cost-of-money rate apparently was approved.

"Standby Inch"

As predicted here some months ago, the Petroleum Administration for Defense is now actively working on the idea of a new giant natural gas pipeline from the Gulf Coast to the heavily-industrialized Northeast area, just as a backstop for oil delivery in case of a major war.

PAD Deputy Administrator Joseph A. LaFortune has met here already with six new advisers (all executives of natural gas companies) with Pentagon officials to discuss the project. The six advisers are to help PAD develop a workable plan to meet a Defense Department request for 1 million-barrel-a-day crude oil pipeline for use in wartime.

The oil industry turned down the proposal when sounded out about it by PAD several months ago. However, PAD now is looking to the gas industry to put in a gas pipeline, which would be converted into a crude oil carrier in case of war.

A few of the problems gone over at the conference here included: (1) Whether there is enough gas available from Texas and other Gulf coast fields to operate the proposed pipeline economically, and (2) how to assure continued gas supplies to consumers, supplied by the proposed pipeline, if the line had to be taken out of gas service to be converted to carrying oil.

The gas company representatives, selected as a result of letters of invitation from Mr. LaFortune to the presidents of the six firms, are:

Walter E. Caine, vice president, Texas Eastern Transmission Co.

John H. Carson, vice president, The East Ohio Gas Co.

J. J. King, vice president, Tennessee Gas Transmission Co.

A. Dale Greene, vice president, United Gas Pipe Line Co.

Walter H. Davidson, general superintendent, Transcontinental Gas Pipe Line Co.

Wilbur T. Shinholser, vice president, Columbia Gas System Service Corp.

Cost of moving storage gas added to inventory

The Federal Power Commission continues to make procedural changes designed, its officials believe, to make accounting and bookkeeping practices easier for utilities and also for regulators in all sections of the country.

Generally, these changes are suggested by representatives of the companies themselves, who have found a new way of keeping track of things, but sometimes they are the result of angles picked up by FPC officials in the course of hearings.

One proposed change would amend the section of the Uniform System of Accounts for Natural Gas Companies (of the General Rules and Regulations) relating to accounting for inventories of natural gas stored underground. This revision would modify existing instructions relative to the cost components to be included in the pricing of inventories of gas stored underground. Present instructions require that transmission expenses incurred in moving gas to the storage area and the expenses of storage facilities shall not be included in the inventory of gas, except as may be authorized by the FPC.

The amendment would eliminate the necessity for individual applications for FPC authority by directing that gas utilized for storage shall be priced at the cost of purchase or production at the entry point on the utility's system, plus the cost of transmission to the underground storage area and the cost of storing the gas underground. The FPC said that the proposed change is necessary to obtain uniformity in the pricing of inventories of gas stored underground, and will aid in the effective administration of the Natural Gas Act.

Publicity seekers thwarted

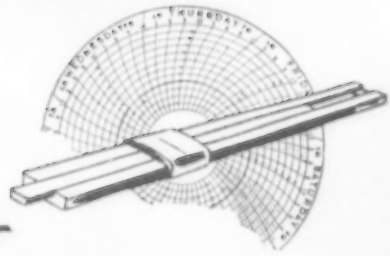
Gas company executives, as well as others in the utility and corporate field generally, will be glad to know that the Securities & Exchange Commission, now under new management, has tightened its proxy rules to curb publicity-seeking stockholders. Other changes were made in its rules that also are of interest to gas management.

The SEC said that the privilege, formerly extended to stockholders, of having proposals included in proxy material distributed by management, is "not desired or needed" now. The new SEC rule prevents a stockholder from bringing before a corporate meeting proposals which, under state law, would not be proper for a vote of the meeting, including matters ordinarily and generally reserved for managerial decision.

Also, under the new SEC amendment to its rules, the corporation is governed by the law of the state in which it was organized, although this may be a different state from the one in which it has its principal offices. The amended rules also give corporate management the right to bar so-called "axe-grinding" proposals, the purpose of which may be to press a personal claim of a stockholder, or to promote "general economic, political, racial, religious, social, or similar causes." To prevent the annual reappearance of proposals which fail to win significant support, the SEC ruled that such proposals legally may be omitted from corporate mailings if they re-

Continued on page 70

Technical Trends



By GUY CORFIELD

Fixation of nitrogen

Researchers of the University of Wisconsin report developments and improvements in the process, initially announced in 1948, for fixation or chemical combination of atmospheric nitrogen by high heating and rapid cooling of atmospheric air, by which process some of the nitrogen and oxygen of the air combine to form about 2% by volume of nitric oxide in the treated air.

The gas-heated furnace used in this process is of the vertical regenerative type and consists essentially of two heat exchange beds of 97% magnesia pebbles ¼ in. in diameter between which is a combustion zone filled with 2-in. magnesia spheres where the air is heated by fuel gas. The magnesia spheres are necessary to obtain good mixing of the fuel gas with the air. In any half of the cycle the air is preheated in the entrance pebble bed, then heated to 2200° C (3992° F) or higher by the fuel gas in the combustion zone, and then rapidly chilled in the exit pebble bed. In the pilot furnace as most successfully constructed, 1500 std cu ft per minute of air will produce 2% by volume of nitric oxide (or about 2.4 lb of nitric oxide) per minute, using approximately 20 std cu ft per minute of natural gas as fuel.

A problem not yet satisfactorily solved is the relatively short life of the furnace refractories because of reduction and volatilization of the magnesia at the highest temperatures. However, with the urgent need for nitrogen fertilizer in modern economy, and the limitless potential supply in our atmosphere, it would seem that this process merits continued study and appears to be quite promising.

Mountain fuel storehouse

The vast and sparsely populated region within and immediately east of the Rocky Mountains has seemed to many to be largely a travel barrier between the densely settled East and the rapidly developing West. It now appears to give promise, however, of being a strategically located gas and oil storehouse for the Continent. Confirming predictions by geologists that petroleum should occur all along the eastern slope of the Continental Divide, from Alaska to the Gulf, a series of "basins" is gradually developing between the Canadian-U. S. border and northern New Mexico.

The most northerly of these, and the one receiving the greatest share of attention and exploration money, principally because of its enormous area, is the Williston basin. It includes portions of the states of Montana, North Dakota, South Dakota, and Wyoming, and the Canadian provinces of Saskatchewan and Manitoba, to a total of approximately 200,000 square miles. The basin currently includes 36 separate oil fields with 290 wells capable of producing 40,000 bbls of oil daily; actual production, however, has so far been hampered by poor pipeline and marketing facilities.

Immediately southwest is the Powder river basin, straddling the Montana-Wyoming boundary; and still further to the west and south are the Big Horn, Wind river, and Green river basins, these latter three almost wholly within Wyoming. Powder river has been the most active with respect to exploration, but Big Horn is so far the largest producer in Wyoming even though it is only 3000 square miles in area; Green river gives some promise of heavy gas production.

To the east, comprising portions of Wyoming, Colorado, and Nebraska, and the northwest tip of Kansas, is the Denver-Julesburg basin, the next in size to Williston. To the south, within the northeast corner of Utah, is the Unita basin; the presence of petroleum has long been suspected here because of extensive oil shale and gilsonite (natural asphalt) deposits.

Last but not least of the eight great mountain basins is San Juan, directly south, in the northwest corner of New Mexico and slightly over the Colorado line. San Juan has, of course, been well known for several years. It is the greatest natural gas area in the Rocky Mountain region, currently producing at a rate of 60 billion cu ft annually and with reserves estimated at about 15 trillion cu ft.

Porcelain enameled aluminum

Confident claims are being made that newly developed enameled aluminum will, in a few years, replace many present uses of porcelain enameled steel as well as finding numerous new applications. This "glass-like" aluminum coating has been made possible through the development by Du Pont of a low-fusion-temperature vitreous enamel frit which will fuse to aluminum at 970-1000° F, about 100° F below the temperature at which aluminum distorts. The resultant coating assertedly has excellent impact, bending and thermal shock resistance. Sheets can be sawed, drilled or punched without fracturing at the edges, and can be heated to 1000° F and then plunged into cold water without cracking, and even welded on the coating. The enamel has resistance to mild acids or alkalies, or other deteriorating influences, equal to that of regular porcelain enamel. Metal surface treatment and enamel application is easier than with steel enameling because lower temperatures are used. Overall cost of enameled aluminum sheet is close to enameled steel.

Beyond the benefits of light weight, the aluminum base metal has advantages over steel for many purposes, being non-corrodible and therefore requiring coating only on the exterior or exposed surfaces. Enameled aluminum is therefore expected to find wide use in home appliances and also for sanitary ware, furniture and architectural tile.

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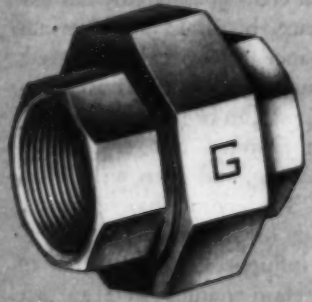

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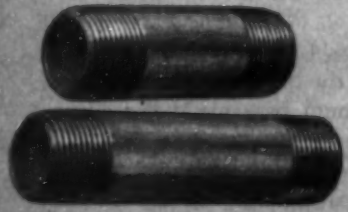

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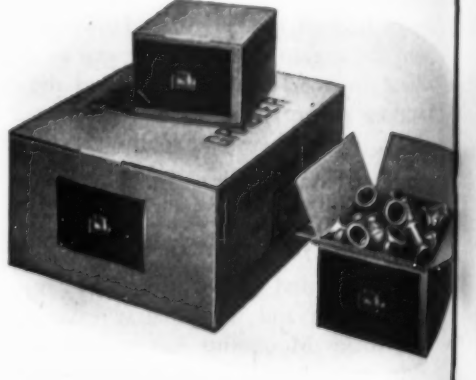

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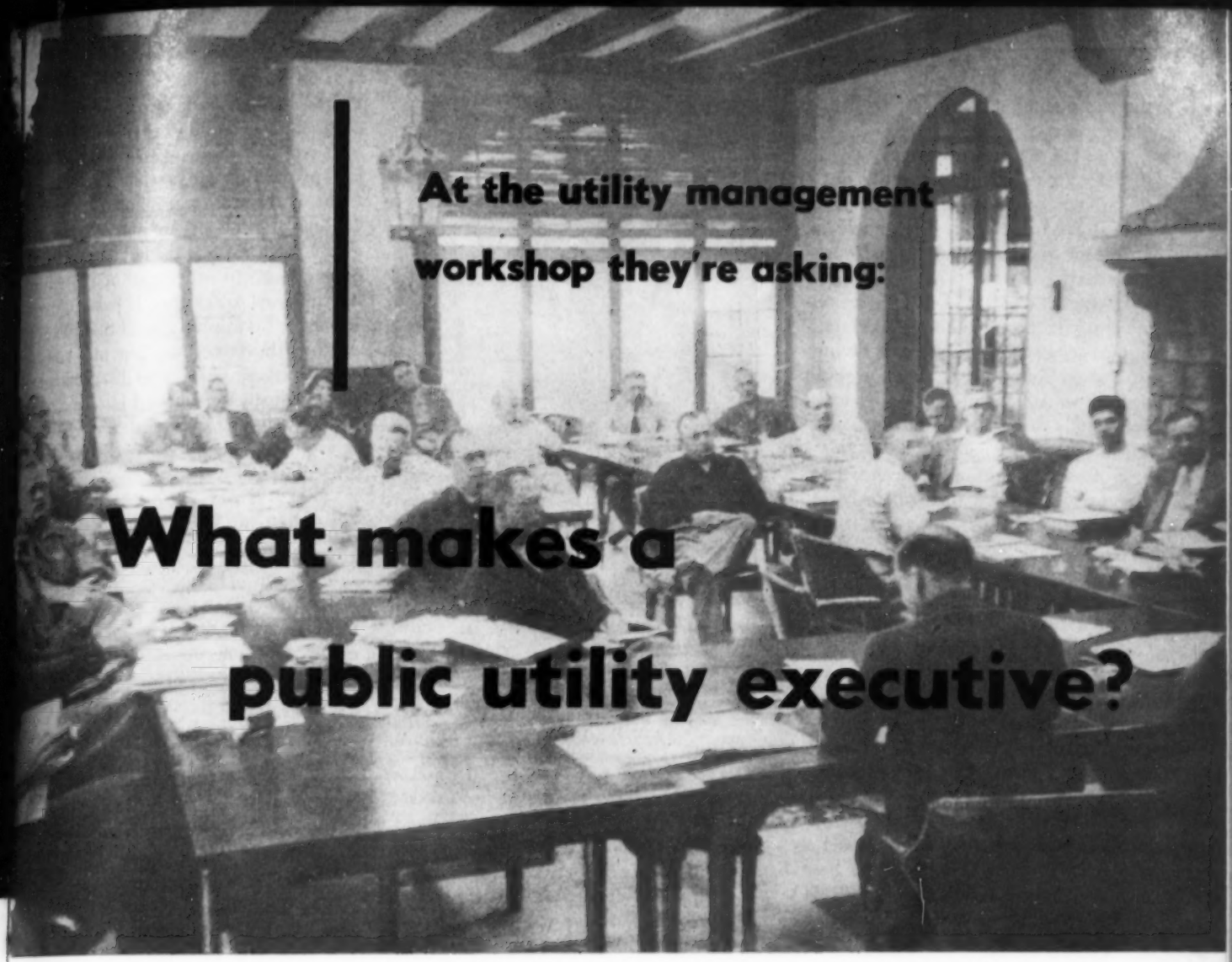


At the utility management workshop they're asking:

What makes a public utility executive?

Shown above are some of the 49 public utility executives who have taken part in sessions of Columbia University's Utility Management Workshop in 1953 and 1952. Workshop purpose: To give the executives a better understanding of themselves and their jobs.

By GEORGE W. GROH

AT THE Harriman campus of Columbia University, 50 miles from New York City, public utility executives have been putting themselves under a sort of wide-angle microscope. They're trying to find out who they are, and how they got to be that way.

Specifically, they're trying to answer two big questions: What individual characteristics does an executive job in utility management require, and how can those individual characteristics be discovered and developed?

These and related questions have been the subject of two-week Utility Management Workshops conducted the last two years by Prof. Robert Teviot Livingston of the university staff. Forty-nine utility executives, including 12 from the gas industry, have sat in as workshop members. A third session, to explore results, will be held on the campus next May 16-24.

The workshop does not deal with the ordinary problems which a utility executive must face. It is not concerned with costs, for instance, or with rates, or with public relations during the period of a labor dispute. The theory is that the right kind of executive will find solutions as such problems arise. The workshop is trying to find out what qualities make an executive "right."

Workshop methods are unusual, too. The two sessions to date have been led by experts in business and other fields —33 persons have served as staff members, consultants or speakers—but these experts do not conduct the main business of the workshop. The main business is conducted on the other side of the table, by members who come to learn.

"We're here to state the problems," Professor Livingston told members at

Prof. Robert Teviot Livingston, workshop director, lectures on three factors which go into any decision, executive or otherwise. The factors are "should, would and could."

GAS exclusive

the last session. "It's your job to find the answers."

We shall see presently what answers the executives made to the big question, the question of what makes a successful executive tick. First, however, a word of background about the workshop itself.

In the fall of 1951, J. W. Carpenter, vice president of the Long Island Lighting Co., suggested to Professor Livingston that Columbia University could make a valuable contribution by making a study of executive training problems in the utility field.

Professor Livingston is executive officer for Columbia's department of industrial engineering, and is also director of research and education for the Long Island Lighting Co. He talked the matter over with a 12-man committee of public utility and education leaders. Out of that came the workshop.

The first session was held Aug. 18-30, 1952, with 25 members attending, and was devoted to "A New Look at the Executive." Purpose of the new look was to define the nature of a utility executive's job, and to lay down some general principles as to how potential executives could be trained for that job. The second session was held May 18-29 the following year, with 24 members attending, and was devoted to a study of the personal qualifications which the executive's job requires.

Members nominated

Workshop members were nominated by their companies, at a fee of $750 per man per session. (Fee for the third session, slightly shorter than the others, will be $720.) Executive qualifications of workshop members may be measured by the fact that those at the first session fell in a salary range of $6000 to $40,000 a year. The range of the second group was $9000 to $24,000, with a $16,000 average. Participating members averaged about 20 years of executive experience each, or an overall total of about 1000 years on the job. Moreover, most of them are still going up. Twelve workshop members have been promoted since attending one of the two sessions.

Workshop members at the first session heard talks by men like Fred R. Rauch, vice president of the Cincinnati Gas & Electric Co.; Jackson Martindell, president of the American Institute of Management, and Dr. Erwin H. Schell, professor of business management at Massachusetts Institute of Technology.

When not talking, or listening, the executives were busy reading. A workshop staff member is shown here with some 60 odd reports and pamphlets used during the second workshop session.

Afterward, they broke up into task force groups to discuss questions like "How can executive talent be developed in groups?" Between discussions they did a lot of reading. In fact, Professor Livingston sent out a list of suggested books three months before the session began.

The second session followed a similar pattern. The speakers were men like Harold F. Smiddy, vice president of the General Electric Co., and Dr. John P. Foley Jr., director of the industrial division for the Psychological Corp., New York City. Task force teams reported on questions like "How can we appraise ourselves and other executives?" The reading list ran to some 60 books and pamphlets.

While the executives worked on self study, Professor Livingston studied them. He made a couple of observations which may be of interest. He observed, for instance, that in 24 hours' time almost every man in the group was on a first-name basis with almost every other man. Within 48 hours, he added, they knew all about each other. Probably that reveals as much as anything else about the special qualities which make for executive talent. Whether from instinct or experience, these men had developed a knack for getting on easily with other men.

They had developed a knack also for amiable agreement. Professor Livingston noticed that because he has conducted similar workshops for research men. He has found that frequently the research discussions were marked by the spirit of dispute.

At a research workshop, Professor Livingston said, a man makes a report at the risk of being flatly contradicted. Someone at the other end of the table may rise up to say that it just isn't so. Professor Livingston found that the executives disagreed, too, but in a somewhat different vein. The disagreement would usually be couched in terms like this: "Well, that's very interesting, Joe; now at our plant, we had a slightly different experience. . . ."

More than tact needed

The head of a business organization needs more than tact, of course, and more than the ability to make friends easily. The executives drew up their own list of qualities which they believe the job requires. Here's the list:

The intellectual requirements were only three: A logical mind, the ability to analyze, and acquired knowledge of both general and specific problems.

Physical requirements were also three: Sound health, good appearance, and good manners.

Requirements of character were four: Moral courage, honesty, fairness

Qualities a management position requires

Intellectual:

1. A logical mind.
2. Ability to analyze.
3. Acquired knowledge of general and specific problems.

Physical:

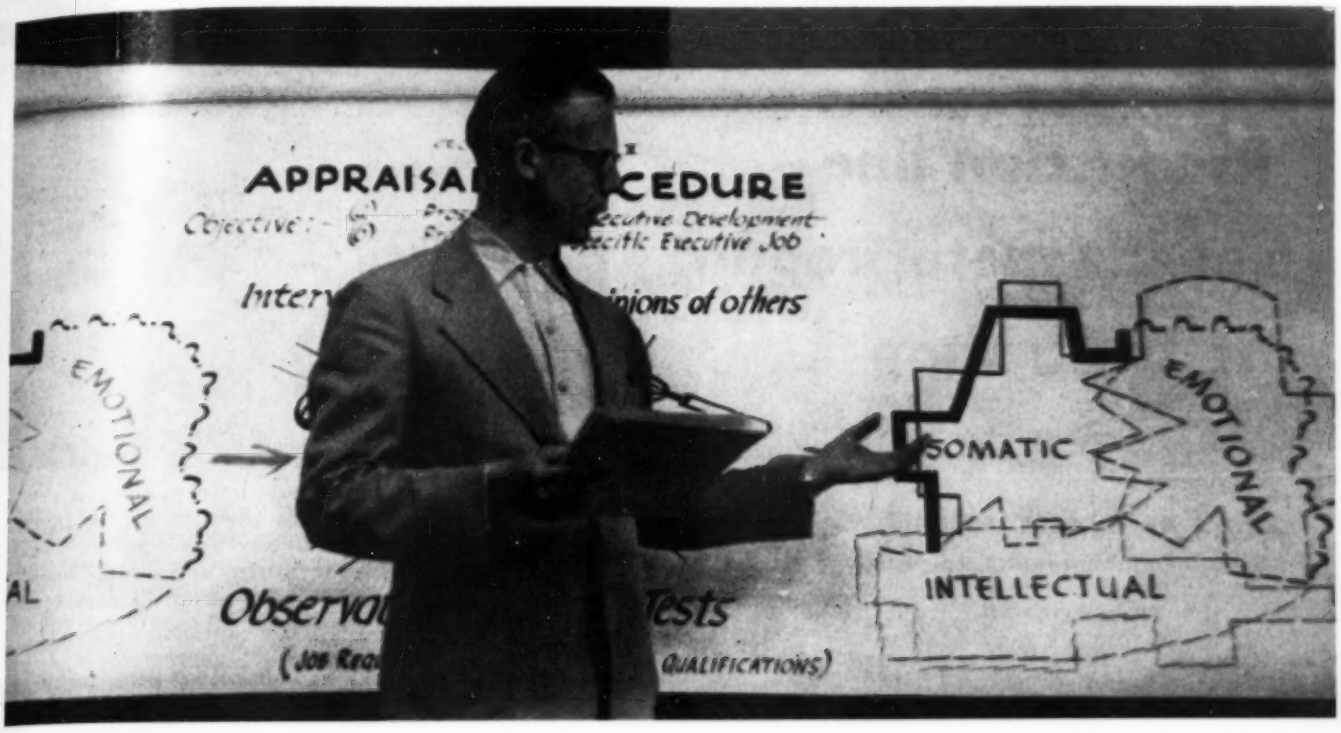
1. Sound health.
2. Good appearance.
3. Good manners.

Character:

1. Moral courage.
2. Honesty.
3. Fairness.
4. Loyalty.

Emotional:

1. Courage.
2. Initiative.
3. Persistence.
4. Self-confidence.
5. Patience.
6. Tolerance.
7. Alertness.
8. Understanding of people.
9. Ambition.
10. Humility.
11. Diplomacy.
12. Sense of humor.



Another "student" who turned "teacher" was Charles T. Dwight, secretary and treasurer of the Hartford (Conn.) Electric Light Co. He diagrams some of the factors—emotional, physical and intellectual—which go into the appraisal of an executive.

and loyalty.

Emotional requirements ran to 12 qualities, the longest list of all. Included were the qualities of courage, initiative, persistence, self-confidence, patience, tolerance, alertness, understanding of people, ambition, humility, diplomacy and a sense of humor.

The size of that list is revealing. Like the workshop itself, it reflects the changing times.

Twenty or 30 years ago, the executive knew exactly where he stood. His company had a certain job to do, and it was his business to see to it that the job was done. He answered to the stockholders, or to another executive higher up, and he could measure success or failure in profits and loss.

Those measurements still apply, of course, but present-day business leaders must deal with other problems as well. They must answer increasingly to employees, to the general public and to government officials. In the utilities business, in particular, final success or failure may be measured by a political election which the executive cannot control.

In short, the executives decided that they must know as much about personal and public relations as they do about specific jobs in business.

Workshop members didn't come up with a pat program for developing the kind of leadership which their job requires. They did make a broad general study of a dozen different systems, and reported on the strength and weaknesses which they found in each.

The oldest and simplest system, of course, is that of job progression. An executive is moved up because he did a good job in his last position. Workshop members found that this system of training has three big advantages. It gives varied experience, provides opportunity to learn by doing, and broadens perspective. Also noted were four disadvantages. They found that the system causes occasional short-term loss of efficiency, is a relatively slow process, can be used for only a limited number of trainees, and requires a good deal of administration.

The job rotation system of executive training was found to have all the advantages of job progression, plus the additional advantage of improving interdepartmental understanding. On the other hand, it had disadvantages in that it causes long-term loss of efficiency, is a slow process, is impractical in small organizations and requires surplus personnel and a great deal of administration.

The understudy system was found to provide intensive training in specific jobs with little short-term loss in efficiency and with a minimum of administration. Disadvantages are that it limits breadth of experience, perpetuates departmental weaknesses and is dependent upon the conscientiousness of the superior.

Among the more complex systems studied was that of multiple management, a training program in which junior executive boards actually participate in company decisions. Workshop members concluded that the system has five advantages. It allows direct participation in management problems, imparts to subordinates the skills and attitudes of superiors, provides observatory testing of potential executives, develops group thinking and cooperation, and produces decisions based on many viewpoints. Disadvantages are that it consumes time and delays decisions, that it may fail to develop individual self-sufficiency, that it divides responsibility and that it requires a great deal of administration.

Other training programs were examined in the same general vein. The conclusion: A perfect program for executive training does not exist. Every program must be adjusted to the needs of a particular company, and to the strength and weaknesses of the particular men involved.

The emphasis was less on systems, and more on men. Workshop members feel that they've made a good start on the problem of executive training when they set out what kind of man the executive ought to be.

Production line speeds meter repair at Tulsa shop

By **GILBERT ESTILL**
Oklahoma Natural Gas Co., Tulsa

4. After disassembly, meters travel by conveyor belt past repair benches. Each repairman can stop or start conveyor with a switch at his bench. As meter reaches proper bench, it is removed by the repairman. After repair, it is returned to the belt and carried to the assembly area.

THE use of an assembly line for the testing and repair of residential meters has made Oklahoma Natural Gas Co.'s new Tulsa meter shop one of the most modern in the U. S. The shop, planned and laid out after a great amount of study had been given to the logical flow of meters through a testing and repair cycle and to the proper equipment for handling meters during the process, has resulted in a saving of considerable time and labor. Designed to handle 100 meters a day, it occupies 9000 sq ft of floor space in the company's recently constructed Tulsa Service Center. (See *GAS*, December 1953.)

Conveyor belt

Center of the shop is a conveyor belt which travels the full length of the shop between rows of meter repair benches. Meters to be repaired are disassembled at one end of the conveyor and carried to the repairman's bench by the belt. After repair the meter is returned to the conveyor and carried to the assembly bench at the end of the line. Control switches located at each of the benches can be used by the repairmen to stop and start the conveyor mechanism.

In addition to the conveyor, the meter shop makes use of a number of other unique methods for handling meters during testing and repair. For instance, the meters are dismantled in a specially designed jig which holds four meters and allows the operator to work on three sides of the meter. Meter position may be changed by rotating the entire jig.

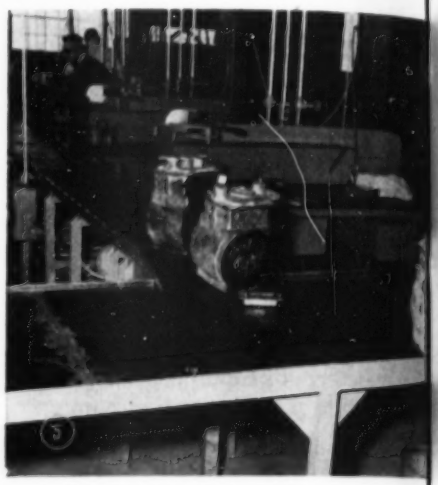
As the meters are received in the shop they are stored in Cargotainers to await test and repair. A separate fork lift truck is assigned to the meter shop for the handling of meter-loaded Cargotainers. When the meters are ready to be put through the test and repair cycle they are first moved in the Cargotainers to preliminary provers.

Cleaning position next

After the preliminary test is completed on each meter it is placed on a long, flat table and pushed to the cleaning position where the outside of the meter is sandblasted. Following the cleaning the meter is disassembled, diaphragms are oiled, and it is placed on the conveyor belt.

As the meters come off the conveyor belt after repair they are completely reassembled, pressure tested and put on a slow fire bench. After passing the slow fire test they are placed on a roller type table which has a gradual slope and allowed to move to the final test prover. At this station the meters are tested, adjusted, retested, sealed, and again placed on the roller table which carries them to the paint booth.

For the final operation the meters are painted in an enclosed paint booth and returned again to Cargotainers for storage. Loaded Cargotainers are moved by the fork lift truck to the storage area.

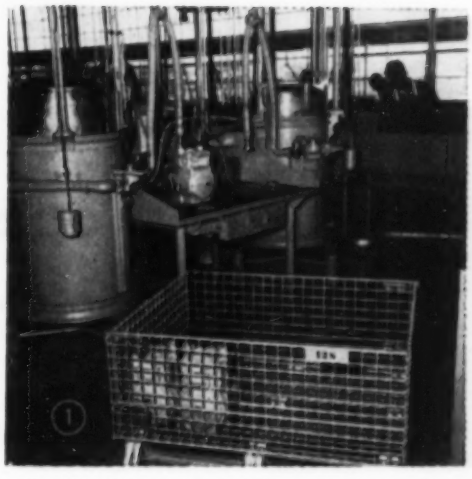


5. Repaired meters come off the end of the conveyor belt on to an assembly table. At this position they are reassembled and given a preliminary test.

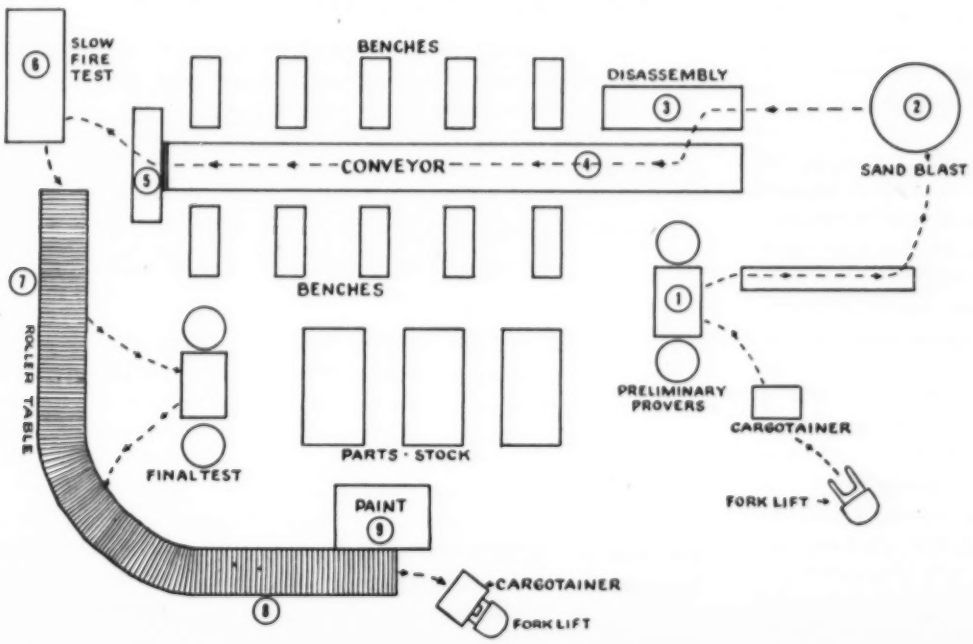
6. Slow fire bench where meters are given a quick preliminary test after they have been repaired. From here they are sent on to the final provers.

3. Specially constructed jig that is used for disassembling meters after cleaning. Jig holds four meters and can be rotated to permit the operator to have access to three sides.

2. Sandblasting device that is used for externally cleaning the meters after they have passed the preliminary provers and before disassembly for repair.

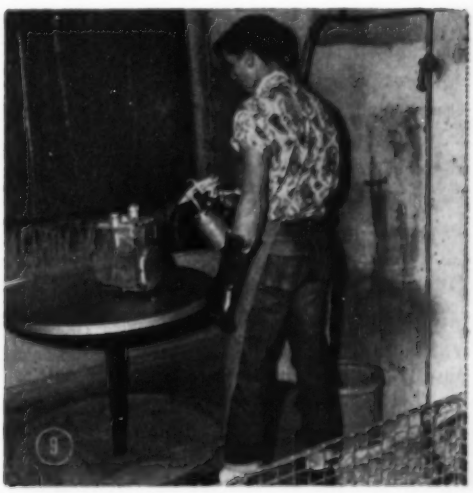


1. Proving position where each meter starts its trip through testing and repair cycle. Meters are delivered in Cargotainers. From here, meters are pushed along table to next station.



7. Roller table carries meters from fire test bench, background, to final prover, right, and then to a paint booth.

8. Meters arriving at the end of the roller table for painting. Table is sloped so that meters move along as those ahead are removed from end of line.



9. At paint booth, meters complete testing and repair cycle. Then they are stored in basket containers and returned to storage with a fork lift.

GAS exclusive

An operating man looks at plastic tubing for gas mains

By C. H. WEBBER • Tucson (Ariz.) Gas, Electric Light & Power Co.

ONE of the first installations* of plastic gas mains was made in the Tucson system last January. In the course of this work, it was necessary that we do considerable pioneering wc k in installation methods and procedures.

The chemistry and technology of plastics have been discussed in numerous articles in the past, and techniques for installing plastic services have been under development for some years. But in the laying of mains, and in the fabrication of suitable connecting devices, the operating man is faced with problems that have not been discussed at any length as yet.

The installation made in our system was, in a sense, experimental; yet in view of the highly corrosive soils in the area, the action was certainly justified.

Four requisites of plastic tubing for use in mains

1. The ability to withstand all ground corrosive actions.

2. The ability to react with a solvent so that the component parts make a homogeneous mass.

3. Impact strength to withstand abuses before and after installation.

4. Ability to expand and contract with changes in ground temperatures.

Present procedure

Before proceeding further on the subject of plastics, it might be well to consider present underground construction procedure.

If we accept steel as the standard material, and one which completely meets all requirements, then further research and development is wasted time. On the other hand, if we consider steel as the acceptable material at the present time, then, if, and when a new and better material is made available, its use should be seriously considered.

Unfortunately, we consider its strength as a paramount virtue of steel as a material for gas main construction, disregarding the fact that, once the pipe is placed in the ground, probably 90% of this strength is never utilized. We install a 4-in. steel main having a working pressure of 1100 psi to carry a product seldom having a pressure exceeding 50 psi. We actually utilize less than one-twentieth of its available strength. Figuratively, we are sending out a 10-ton truck to do the work of a ½-ton pickup. Then, it can be reasoned that 19 out of every 20 tons of steel is installed for reasons other than that for which it is intended; namely, to deliver our product to the consumer in a safe, dependable, and economical manner.

Of course, the reasons why steel pipe cannot be tailored to the job are obvious. Thin walls would not allow proper welding or joining and, because of the characteristics of steel, the thin walls could easily be penetrated or fractured from some outside source. Of more importance is the fact that our vicious enemy, corrosion, would have a field day. Therefore, it sums up that we are willing to sacrifice 90% of our steel.

If strength is the paramount virtue of steel, then its inability to withstand corrosion is its weakness. If we continue to use steel, particularly in corrosive soils, we must combat this weakness. Hence, the all-important subject of underground corrosion control, on which volumes have been written—and continue to be written—indicating that the problem has not been satisfactorily solved. We must accept the opinion of the experts: without adequate corrosion control, many of our systems would be in poor shape.

Experts agree

The experts all agree on certain procedures—surveys of soil conditions, proper protection for the pipe itself, installation of sacrificial materials, proper insulation from other underground structures, and a continual police action. This means added personnel, and, in the case of the smaller utilities, will materially increase operating ratio.

On the other hand, what are the requirements of a plastic material to be used underground for the delivery of our product? When we bury the material, it is not subject to visual inspection from time to time, as is generally the case with other plastic materials. We must be certain that the mistakes made by the automotive industry sev-

*According to available information, plastic mains were used in at least three systems last year—in Hastings, Neb., Avalon, Catalina Island, Calif. (*GAS*, July 1953, pages 32-33), and Tucson. Tucson appears to have been the first of the three by a matter of a couple of months.

eral years ago, in using the wrong types of plastic for automobile accessories, are not made by us. Fortunately, there are plastic materials available today that will meet our requirements.

The first requisite is its ability to withstand all ground corrosive actions.

Its second requisite is most important. Its characteristics should be such that a suitable solvent can be applied which will so react that two pieces of the same material can be joined in such a manner that the component parts make a homogeneous mass. In other words, a welded or bonded connection, rather than a cemented fit must result. The importance of this feature is primarily due to the fact that all plastics have much higher cold flow or creep than other materials, causing stresses and distortions; and the connection must be of a nature to absorb these conditions. Threaded connections should not be used. In the case of threaded connections, distortion will sooner or later take place, resulting in leakage.

Compression coupling

Connections to existing steel mains should only be made using some sort of compression coupling, with a thin steel insert inside of the plastic to give the rubber gasket a proper footing. With the proper welding or bonding of all connections, cold flow or creep then becomes equalized.

The third requisite is impact strength, which will allow it to withstand certain abuses, both before it is installed and after it is placed in the ground. It must withstand the usual hard usage associated with hauling and stacking, without shattering or distortion. When once installed, it must be of a character that will withstand the chance hitting by hand tools, such as picks and shovels. One unorthodox test of its impact strength is to take a length, lay it on the ground or pavement, then run an automobile over it back and forth. If, after this test, the material shows no weaknesses, it can be assumed that, for all practical purposes, it will absorb any normal abuse.

C. H. Webber is superintendent of the gas department for Tucson (Ariz.) Gas, Electric Light, & Power Co., with whom he has served for more than 30 years. Previously, he had spent 10 years in the gas business in California, including three years as superintendent of gas operations for the Citrus Belt Gas Co., and for the City of Redlands.

The fourth requisite is its elasticity or ability to expand and/or contract with change in ground temperatures. Generally, acceptable plastic materials have a coefficient of expansion of from 8 to 20 times that of steel. Some materials will expand or contract some 6 in. per 100 ft with a ground temperature of 30° F.

Original state resumed

Tests indicate that the material, elongated and under stress from temperature change, will resume its original state when strain is released. However, good practice would be to make installations at a time of the year when temperatures are minimum.

Strength should not be considered as a requisite, since strength of the material can be controlled in the manufacture. At the present time, plastic pipe for gas main construction having a bursting pressure at 77° F of from 400 to 450 psi and a working pressure of 100 psi is being extruded. If increased strength is needed, wall thickness can be increased.

The remaining factor to be considered is the period of time that the material will function properly underground. Depreciation of steel gas distribution mains is usually set up, giving a useful life of from 30 to 40 years. Actual life should be considerably longer. Eliminating corrosion, steel should last indefinitely. Since it is a new material, the life expectancy of plastics is unknown. If deterioration and breakdown occur, they will probably come from the material itself, rather than from an outside source, as is the case with steel.

Nine years' experience

This we do know—that plastic services have been in the ground and in active service for nine years, and inspection discloses no perceptible change. We also know that cellophane, used as a wrap on steel pipe installed some 17 years ago, still retains its original characteristics.

Considering the situation from a comparative standpoint, we should ask ourselves: Shall we continue to install steel in known corrosive soils and take a chance on maintaining 100% protection to this steel, or shall we install plastic, knowing that it has an established record of 17 years of life, and, according to all available data, an indefinite expectancy?

The announcement several months ago that the major steel companies were experimenting with plastics to the extent of building pilot plants and, in several cases, of purchasing existing facilities, clearly indicates that the steel industry is keenly interested in plastics. The pipe mills are in the business of supplying a commodity, regardless of the materials necessary for its production.

Unfortunately, to date, information on the behavior of plastics underground and, particularly, as applying to our industry, is very meager.

A confusing condition also exists regarding sizing. At the present time the extruders are marketing plastic pipe in standard OD pipe, copper pipe, and plastic pipe sizes.

The fact that standard OD pipe sizes are now being universally used by the gas industry certainly justifies the adoption of that size. It also is my opinion that certain wall thicknesses should be made standard, and classified as stan-

Rule of thumb

2-in., 4-in., 6-in. plastic will cost approximately 19%, 34%, 29% of steel

dard, extra strong, and double extra strong, thereby giving individual utilities a choice of strength to meet their particular requirements.

In considering costs as is done in the accompanying box (see "Rule of Thumb"), using wrapped steel pipe as a comparison, it should be remembered that plastic has approximately 15% more carrying capacity, because of the smoothness of the walls. Also, the cost of soil surveys, anodes, insulating couplings, and policing, which are necessary for any steel installation, are not included. All plastic sizes have a presumed working pressure of 100 psi. Both plastic and steel are in standard OD pipe sizes.

Actual information is only available on installing 2-in. plastic. Two men can easily lay 600 lineal ft per hour, under average conditions.

The market is still limited at the present time, but both the manufacturer and extruder should be able to materially reduce prices if and when volume reaches a point where fixed charges can be more equitable.

Tucson installation

Following is a brief description of the installations made in the Tucson area:

One installation consisted of 7500 ft in a suburban area. The soil is highly corrosive, consisting of a conglomerate of fine silt and adobe. The plastic replaces wrapped steel, which was installed 12 years ago. A pressure of 45 psi is carried in the main. Two other installations were made in small subdivisions. Soils are not highly corrosive, the locations being selected as representative of our territory, and consist of stratas of sand, caliche, decomposed granite, small rocks, and the garden variety of dirt. Pressures of 15 psi are carried. The mains are located in easements and are of sufficient distance from any underground structure that no hazard exists in the event of failure. The spoil was returned to the trench as removed. This should prove an excellent test as to the ability of plastic to withstand any mechanical action of the ground. One other installation of 300 ft was made in a downtown area, where soil is highly corrosive. Again, this location was selected as being a considerable distance from any existing basements or other critical structures. A pressure of 10 psi is carried.

Periodic 60-day tests are made, consisting of thorough leakage surveys and the uncovering of the pipe at several locations to determine its condition.

The plastic was fabricated from cellulose acetate butyrate (Tenite II). All joints were solvent-welded, and connections made to steel mains by Dresser couplings.

Other material tried

The fact that we chose Tenite II is not intended to signify that this is the only acceptable material at the present time. We have carried on numerous shop and yard tests on a material known as tri-polymer acrylonitrile, marketed under the trade name of Kralastic. The material has the necessary bonding, impact strength, and modulus of elasticity for underground installations.

If proper bonding solvents are developed for vinyls, such material might be considered, particularly in view of recent improvements made in their general structures.

It was apparent from the first that no practical method of connecting services to plastic mains was available; so a plastic fitting that could be solvent-welded to the main, and the service connection made in a matter of minutes, was devised. This fitting (shown on this page) will be marketed shortly by the Mueller Co.

Future of plastic

The experiences of the past 12 months, both in the field and yard, as well as the shop, have demonstrated to our satisfaction that plastic materials have a definite place in the construction of our underground systems. Their use will be retarded unless each gas utility will initiate a plastic project into its future program, thereby demonstrating the merits or any shortcomings of the material.

How the author's plastic connecting fitting works

The plastic service fitting (see text) consists of a plastic body and cap, and an expendable metal drill. The plastic body is first bonded to plastic main and held in place by a suitable clamp (not shown). The plastic service is then run from side outlet, after which expendable drill is screwed down, tapping the main. Plastic coupon is retained in drill. Drill is then backed off a point where it permits a full flow through pipe. The plastic cap is then screwed on top and either sealed permanently with solvent or backed up against a suitable gasket. Installation clamp is then removed.

Assembled parts include drill (at left), fitting, and cap.

After drill has tapped main, it is backed off. Plastic coupon is retained in drill.

Completed service connection, with cap sealed and in place, is ready for backfill.

Judgment against Northeastern rejected on "hearsay" evidence

Hysteria over pipeline blowouts held not sound basis for property damages

A RATHER widespread head-in-the-sand attitude which has characterized management reaction to public relations in the past has been shown up for the peril it is in recent events in the East and Northeast. Unduly alarmed over the grossly exaggerated hazards of natural gas at high pressures, residents of certain areas in New Jersey, Connecticut, and New York state have during the past two years thrown every block at their disposal at new pipeline construction attempting to traverse their neighborhoods.

Fortunately for the industry, our courts are not swayed in their judgment by hysteria and unsupported fears. Thus, when a court-appointed committee in a condemnation action recommended that Northeastern Gas Transmission Co. be forced to pay a total of $122,438 in damages to four property owners in Stamford and New Canaan, Conn., the superior court judge, John T. Cullinan, rejected the report on the basis that the measure of damages as recommended was predicated on hearsay evidence.

Judge Cullinan named a new committee to review the matter and offer new recommendations.

Nevertheless, the now-famous "1712 pipeline failures" referred to in this case and in the Congressional Record will no doubt continue to pop up to embarrass the industry until, at some future day, concrete preventive measures are adopted nationally. The matter of blowouts transcends safety considerations alone. The "safest" pipeline failure in history may yet do untold harm to the industry's relations with the public.

As a matter of interest, the memorandum of decision is reproduced here.

By order of the superior court, its committee, comprising Attorneys Matthew E. Hanna, Lloyd J. Vail, and John Keogh Jr., heard these four condemnation actions for the purpose of assessing damages to the several defendants by reason of the plaintiff's having taken easements for the construction and operation thereon of its natural gas transmission pipeline. To the defendant, Helen G. Altschul, was awarded $38,-850; to the defendant, George H. Jelliff Jr., was awarded $10,575; to the defendant, Antoinette D. Lapham, was awarded $68,116.25; and to the defendant, Joseph Weber Jr., was awarded $4896.75.

By agreement of counsel, much of the evidence presented to the committee was made applicable to the four cases, the principal exception being the evidence as to the value of the damage suffered by each separate property. The committee filed an independent report in each proceeding; the reports, however, being substantially identical in their findings save for the amount of damage which varied in each case. Thereafter the plaintiff filed individual motions to correct the committee's reports; the motions being substantially identical as were the separate decisions of the committee on these motions to correct. The plaintiff has filed separate exceptions to the report (as amended) of the committee and to its acceptance in each case, but counsel have agreed that decision of the basic issues in any one matter will apply with equal force to the four actions.

The plaintiff has made a many-sided attack on the report of the committee, a circumstance which has required a meticulous study and re-reading of the 2100-page transcript of testimony. Its exceptions to the report run the gamut from attacks on evidential rulings and conclusions reached by the committee to a substantial quarrel with the committee's basic philosophy of damage as reflected in its awards to the several defendants.

In its report, the committee has detailed the factors considered by it in computing damages. They include: "the effect on the market value of the defendants' real estate by reason of the apprehension of explosions and resulting fires in the minds of the reasonable buying public, which has been brought about by the widespread publicity concerning other explosions; the permanent easement over a strip 30 ft in width and the temporary easement for an additional 20 ft; the swathe cut through woodland along the easement, which in places is unsightly; certain relatively narrow or constricted areas which have been greatly depreciated because of the fact that the pipeline, in effect, detaches these areas from the remainder of the defendants' properties, leaving these dislocated areas of little practical value; various problems which are likely to arise by reason of the existence of the pipeline in connection with the future development of the property; the right to construct additional pipelines in the future; and the right to traverse the easement for purposes of inspection and repair."

The committee further found that there have been approximately 1712 ruptures of natural gas transmission pipelines in the United States during the last 10 years and that publicity, attendant upon these explosions, has caused a substantial depreciation in the value of real estate through which plaintiff's pipeline passes. On the basis of this finding, the committee concluded that apprehension on the part of the buying public is reasonable and well founded, constituting a proper item for consideration in the ascertainment of damages.

The sole basis for the finding concerning the 1712 pipeline ruptures is predicated on a report of the Federal Power Commission, which report ultimately appeared in the Congressional Record. (Tr. pp. 423-433.) The contents of this report constituted hearsay evidence and no attempt was made to establish the truth of the material within the Congressional Record. Even assuming credible and legally sufficient evidence to support this finding of 1712 pipeline failures, there was absolutely no supporting evidence relating the causes thereof to similar or substantially similar conditions existing in or to be reasonably anticipated in connection with plaintiff's pipeline on defendants' properties or elsewhere within Connecticut. Yet the committee repeatedly found the fact of the explosions from the publicity. (See Report of

Committee: "Many of the explosions within recent years . . ."; "This publicity concerning explosions . . ."; "although damage has occurred at distances up to approximately 3000 ft from pipe explosions . . .".) Further the defendants were permitted by the committee to introduce as evidence 17 newspaper articles of purported pipeline failures. (Exs. 8, 9 and 10.)

Admission of these publications as proof of the purported facts contained therein violated the rule against hearsay evidence and the committee's findings based thereon are erroneous. Public belief resulting from such publicity is not material or relevant until proper evidence of the facts recited therein has been offered, since, in the absence of such evidence, the public belief cannot be regarded as well founded and the damage, if any, resulting therefrom is "not a necessary, natural or proximate result of the taking." (Meriden v. Zwalniski, 88 Conn. 427; Andrews v. Cox, 127 Conn. 455.)

There is sound reason in public policy for the rule adopted in Meriden v. Zwalniski, supra. Organized resistance of minority groups with the adverse publicity and propaganda fostered by such groups against a variety of public improvements is a matter of common knowledge as is the fact that once such improvements become a reality, the hysteria incited by the opposition abates or disappears. If such publicity could properly be considered in arriving at the damages for the taking of property for such improvements, the ultimate cost to the public would be an excessive burden far beyond the realities of the loss to the property owners.

Nor is the evidence as to explosions or ruptures of other pipelines relevant to the possibility of such an occurrence on plaintiff's pipeline without evidence relating the conditions under which such failure occurred to similar or substantially similar conditions existing in or to be reasonably anticipated in connection with plaintiff's pipeline. The basic principle as stated in Wigmore on Evidence (3rd Ed.) No. 442 as follows:

> "The general logical requirement is, then, that when a thing's capacity or tendency to produce an effect of a given sort is to be evidenced by instances of the same effect found attending the same thing elsewhere these other instances have probative value—i.e. are relevent—to show such a tendency or capacity only if the conditions or circumstances in the other instances are similar to those in the case at hand."
>
> "The similarity that is required is, in short, a similarity in essential circumstances, or, as it is usually expressed, a substantial similarity, i.e., a similarity in such circumstances or conditions as might supposedly affect the result in questions."

The rule in Connecticut is that other instances are irrelevant unless they occurred under conditions substantially similar to those in issue, Wilkins v. G. Fox & Co. Inc., 125 Conn. 738; Wray v. Fairfield Amusement Co., 126 Conn. 221; or under conditions "substantially similar in all relevant respects to those present when the accident occurred." (Dobosz v. Nyren, 131 Conn. 270.)

The committee specifically based its awards, to an undisclosed extent, upon public fear or apprehension resulting from publicity concerning other explosions. Moreover from a careful analysis of the committee's report and the zonal

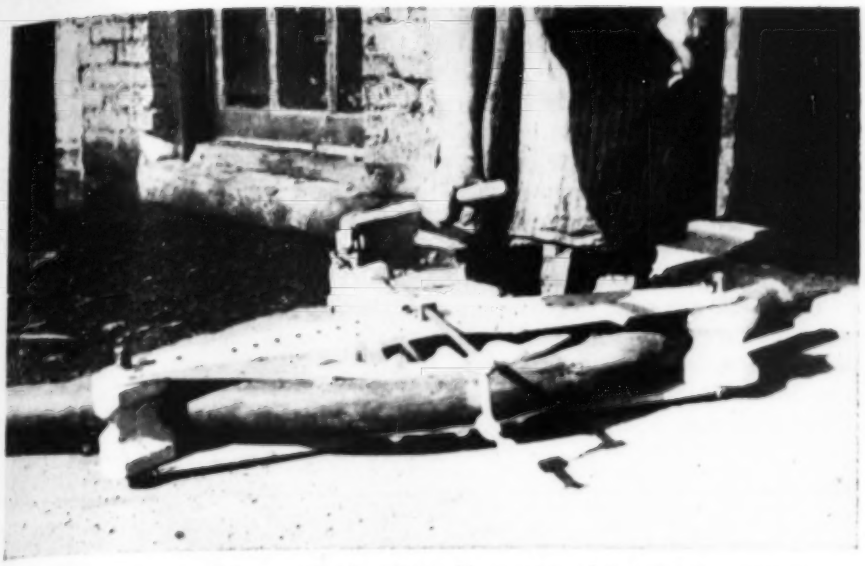
theory of depreciation adopted by it, it is apparent that the committee's awards were based primarily upon apprehension of danger from plaintiff's pipeline. Connecticut has aligned itself with the general rule that mere general and unfounded fears of future injury to person or property by reason of the proposed construction or operation of a public improvement cannot be made the basis for depreciation in the value of the remainder of the tract. (124 A.L.R. 407, 413.) It has been held, for example, that fear of danger from an electric power line cannot be the basis on which to predicate depreciation in market value. (Alabama Power Co. v. Keystone Lime Co., 191 Ala. 58, 68.)

The Alabama court made the further observation that a large percentage of the agencies which conserve human effort are, when negligently controlled, dangerous to human life, and many objects now used upon our streets and highways were, when first introduced, objects of terror to those who knew nothing about them, citing the automobile as a case in point. Said the Alabama court: "If it be true that some people who have not grown accustomed in lines similar to that of appellant are afraid of this improvement, and that therefore they are not willing to buy appellee's lands, the law can furnish to appellee no remedy therefor, and cannot regard depreciation created by such a cause as resting upon any substantial basis." Similar holdings are to be found in Illinois Power & Light Corp. v. Barnett, 338 Ill. 499; East St. Louis Light & Power Co. v. Cohen, 333 Ill. 218; Rockford Electric Co. v. Browman, 339 Ill. 212; Hopkins County v. Rodgers, 275 Ky. 778; Wahlgren v. Loup River Public Power District, 139 Neb. 489; and Scully v. Central Nebraska Public P. & I. District, 143 Neb. 184.

Further consideration of the numerous exceptions to the committee's report becomes unnecessary since the awards must be set aside as having been arrived at under an erroneous concept of the proper factors to be evaluated in arriving at a just ascertainment of damages. The committee expressly based its award of damages, to an undetermined extent, upon the existence of a public belief as to possible speculative accidents which under Meriden v. Zwalniski, supra, is not material in the absence of a finding as to the actual existence of an unsafe condition in plaintiff's pipeline, a finding which the committee failed to make. Furthermore, the contents of the Congressional Record cannot be accepted as proof of the purported facts recited therein and the committee's finding of 1712 ruptures of natural gas transmission lines during the past 10 years, which finding was based solely on testimony as to the contents of the Congressional Record, constituted harmful, prejudicial and reversible error.

Section 1075b (1951 Supp. Gen. Stat.) provides: "Said court (superior court) or judge may accept such report or may reject it for irregular or improper conduct by such committee in the performance of its duties. If the report be rejected, said court or judge shall appoint another committee which shall proceed in the same manner as the first committee was required to proceed. If the report be accepted, such acceptance shall have the effect of a judgment in favor of the owner of the property against such corporation for the amount of the assessment made by such committee."

Accordingly, it is ordered that the reports in the within four matters be rejected.



A 45° bend is made in one single setting. No moving of the pipe is necessary.

How on-the-job bending trimmed storage piping installation costs

By **W. R. SCHUH** • E. D. Wesley Co., Milwaukee

A 75% saving in the cost of materials and labor—finishing the job 10 days ahead of the contract time—an installation more efficient in operation—a streamlined effect that makes beauty of a maze of pipe.

All this is not only possible, it's a certainty for almost any average pipe installation if the pipe is bent. Every one of these advantages was ours through the use of pipe benders on much of 22,074 ft of pipe work we recently completed.

90-day time limit

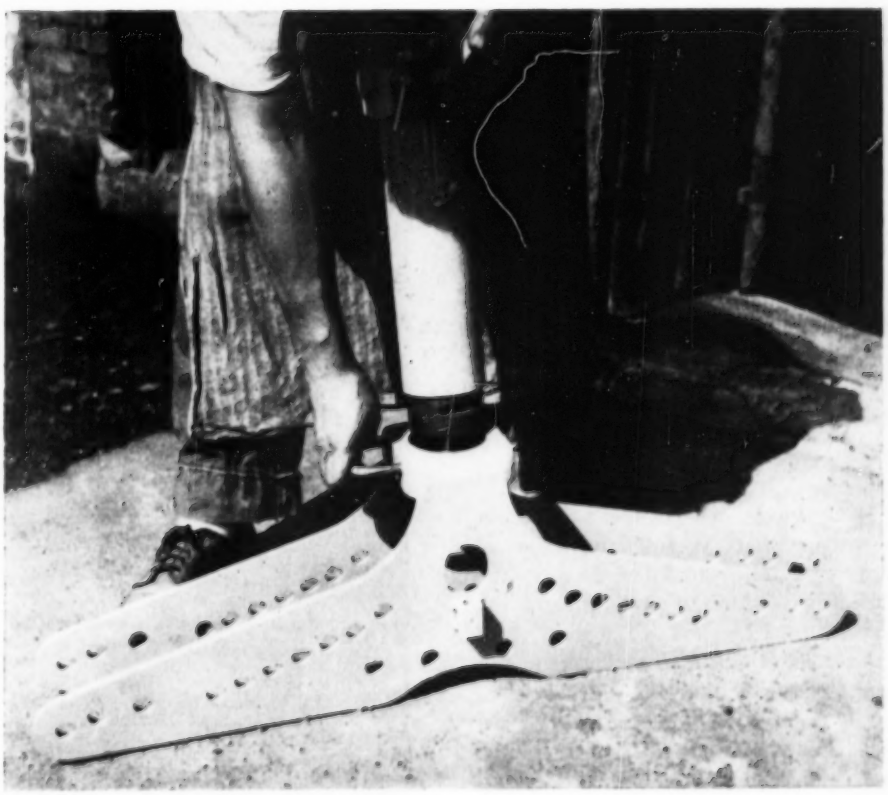
When we were awarded the pipe work contract with a 90-day time limit for a $1½ million project, the erection of four oil storage tanks on Jones Island in Milwaukee for the Wisconsin Petroleum Terminals Inc., we made it the largest pipe bending job for any oil terminal in Wisconsin.

Most of our work consisted of the connection of foam lines for fire prevention from the foam house to the four storage tanks, one of them of 268,292- cu ft capacity, 90 ft in diameter and 42 ft high, and the other three having 185,550-cu ft capacity, 75 ft in diameter and 42 ft high. It was natural, consequently, to concentrate our pipe bending on the 4-in. pipe, of which there was 10,020 ft, and the 3983 ft of 3-in. pipe involved. We did, however, use pipe benders also on 1234 ft of 4-in. product line used to load tank cars and 380 ft of 2-in. product lines.

In all we made 135 bends along with 32 offsets at a saving in materials of more than $800 at a conservative estimate, plus 270 hours in time and labor cost over what welded fittings would have cost us. Such savings are readily realized when it is figured that one bent offset, alone, eliminates two fittings and four welds besides taking only a fraction of the time.

Element of time

This element of time to complete a welded ell as opposed to a bend is a major contribution to the saving in labor cost. To illustrate the difference, a 90°, 4-in. welded ell costs $16 for the material, and two hours time is required to fit up and weld it. The bend, though, would be only $3, since the material comes to just $1 and the labor cost to $2 with just 45 minutes needed to set



Assembly of the bender is simple. Only two main parts: the hydraulic unit and the frame are put together in less than one minute with a "U" key.

Difficult places to put in welded ells because of space limitations offer no problem when the pipe is bent.

up and measure it and two minutes for the bending. The 90°, 3-in. welded ell requires about one and three-quarters hours to fit up and weld, at a cost of $13. In comparison, the bend would be just $2.50; $1.90 for labor for setting up, measuring and, bending it in a little under 45 minutes, and 60 cents for the pipe. The 45° welded fitting in 4-in. size costs $15 and in the 3-in. size $12, while about the same cost holds true for bending as with the 90° bend: $3 and $2.50.

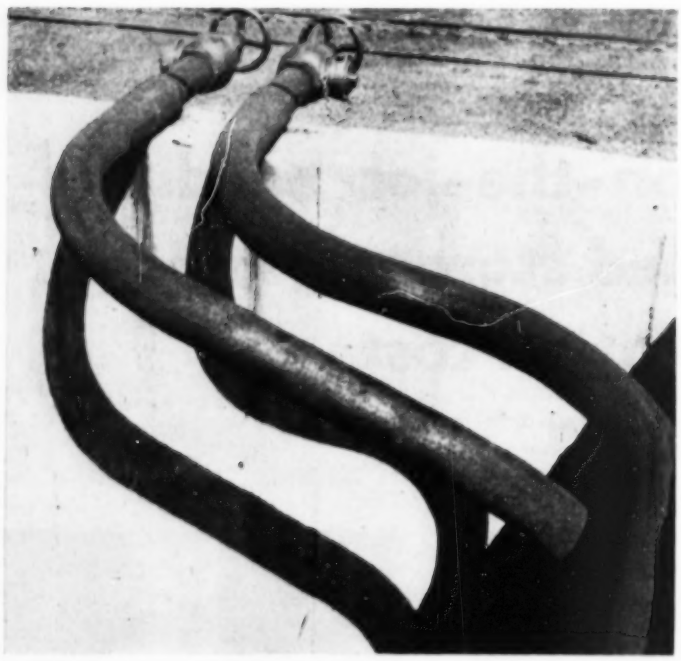
Add to the above differences in cost the further appeal of unlimited direction which can be taken and the offset which can be made and the reason we cannot recommend pipe bending too highly is evident. With fittings it would be necessary to use the standard 90° and 45° ells and trim them for any variance.

Bent pipe advantages

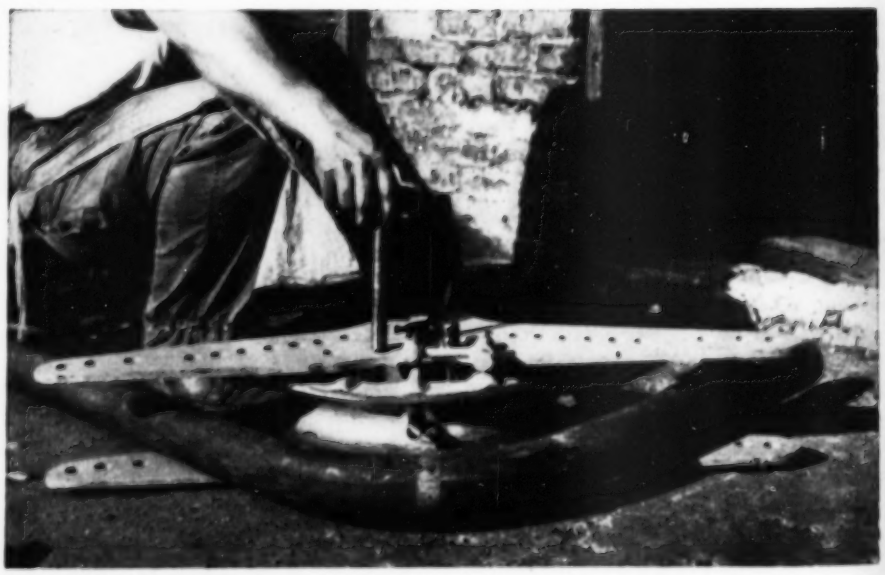
One thing that should be pointed out clearly is that the full advantages of bent pipe are obtainable only when the bending is done at the job and the proper pipe benders are utilized. It is possible to buy pipe already bent, but the cost for the bending is about three times what it would be if done at the job. At about $50 in labor cost, two men can set up, measure, make and install six 90° bends in 6-in. pipe in eight hours. If the pipe were bought, the charge made to equal the bending is about $150, which is incorporated into the total price.

We encountered some difficulty in finding the right benders. At first we attempted to use cheap pipe benders with short formers, which required that the pipe be moved a number of times to make a 90° bend. This needed much skill and time, and then the bends were not perfect and identical. On changing over to the Tal One Shot Bender, which has a long ram, makes use of half-circle shoes instead of short formers, and has a bend indicator, we found that the bends could be made perfect fitting and identical in one setting without hardly any training.

The use of bent pipe creates still another saving in that its salvage rate is practically 100%. The tendency when a mechanic uses an ell is to take a joint of pipe longer than needed and cut off the extra length, which, in all likelihood becomes scrap. Not only does the sweeping curve of a bend (rather than a direct right angle) lengthen the pipe but the mechanic will readily weld on a short piece to bring it to the required length.



Difficult configurations such as this are made relatively easy with the field-bent pipe.



Shoe with pipe was fastened to frame and pipe pushed out of shoe with push-out pin.

Summary and Comments on
Gas Versus Electric Refrigerator Tests

1. Monthly Energy Consumption and Cost
Gas Refrigerator 1.384 M.C.F. $ 0.90
Electric Refrigerator 78 K.W.H. $ 1.56

Ratio - Electric Cost to Gas Cost $1.56 / 0.90 = 1.73

(Above costs on basis of 65¢/M.C.F. for gas and 2¢ per K.W.H. for electricity).

2. Temperature readings at the flue outlet of the gas box and in the air stream from the compressor in the electric box, when operating, (not on defrost) were:

260F above room temperature on the gas box.
209F above room temperature on the electric box.
While this indicates that the gas box emits more heat into the kitchen than the electric box, the difference is not as great as our electric competitors claim.

3. Value of the Gas Refrigeration Load.
The test, conducted under simulated home conditions, indicate a monthly consumption of 1.38 M.C.F. for the gas refrigerator.
Equitable Gas Sales and Market Research, Gas - Electricity Comparison, dated 2/9/50 shows an average monthly consumption for ranges of 1.233 M.C.F. per range.
The gas refrigerator is a better load builder than the gas range.

C. L. Benn
C. L. Benn
Chief Utilization Engineer

5-28-53

Gas refrigerator operating economies proved in test

By R. N. SINDELL
Equitable Gas Co., Pittsburgh

IN Pittsburgh, it's cheaper to refrigerate foods with gas than with electricity. And the gas refrigerator is a better load builder than the gas range.

These findings were clearly shown in a gas v. electricity test which has been conducted by Equitable Gas Co. under the direction of C. L. Benn, chief utilization engineer.

At 2 cents per kwh for electricity and 65 cents per Mcf for gas, monthly energy cost at the rate of consumption established for the tests totaled 90 cents for gas as against $1.56 for electricity. Energy consumption for the refrigerator was 1.384 Mcf, as compared with an average monthly consumption for ranges of 1.233 Mcf as established in a research study some four years ago.

The tests were conducted under closely controlled conditions, utilizing two Servel refrigerators of comparable capacity and operating characteristics —the Model 938-G 9-cu ft absorption type gas unit and the 938-C 9-ft electric model. The natural gas used was rated at 1030 Btu and the research was done under accurately recorded room temperatures. From 8 a.m. to 5 p.m., an air conditioning system was in operation, keeping the mean room temperature at 77° F. During the night hours, with the air conditioning off, the mean room temperature was 84°.

The refrigerators are both equipped with food storage compartments and freezing compartments with individual doors for each compartment and automatic daily defrost.

Equipment used in the work included the following items:

2—Electric Telechron clocks for timing.

1—5-Light Tin gas meter with 12-in. diameter 10-cu ft dial graduated in tenths of a cu ft, also in 0.0065 of a cent based on a 65-cent-per-Mcf gas rate and with an inset 100-cu ft register with 10-cu ft graduations. Meter equipped with zero resetting device.

1—3-wire 220-110-v kilowatt hour meter with 12-in. diameter 500-watt-hour dial with 5-watt-hour graduations, also 0.01 of a cent based on a 2-cent-per-kwh electric rate and with an inset register of kwh graduated in 500-W.H. meter with zero resetting device.

1—2-wire 110-v kilowatt hour meter with four registers, with smallest register 0.01 kilowatt hour, without resetting device, used as a check meter on three wire kilowatt-hour meter.

4—Tel-true refrigerator thermometers.

1—Brown Duplex recording thermometer.

Tel-True refrigerator thermometers were placed in both the freezing and food compartments of both boxes.

The gas refrigerator was connected through the five-light tin meter with the gas pressure ahead of the meter held at 4 in. water column by a gas pressure regulator. The gas pressure to the refrigerator burner was controlled by a second regulator set at 2.3 in. wc pressure for maximum flow and 0.2 in. for minimum flow.

One refrigerator thermometer was placed in the center of the freezing compartment and one in the approximate center of the food compartment.

One thermometer bulb of the recording thermometer was placed over the condenser unit and flue of the gas refrigerator for the first 24 hours, and then at the rear of the electric refrigerator 1 ft above the sealed unit for the next 24 hours in order to record the relative operating temperatures and operation cycles.

The second recording thermometer bulb was used to record room temperature adjacent to the sides of the refrigerators and 4 ft above the floor.

The electric refrigerator was connected through both the three-wire and two-wire kilowatt hour meters.

Refrigerator thermometers were placed in the electric refrigerator freezing and food compartments in the same locations as in the gas refrigerator.

Both refrigerators were started in operation with the doors sealed at 2 p.m. May 15, 1953. The temperature controls were set on No. 8 on each refrigerator.

At 3 p.m. May 17, the doors were opened on each refrigerator and the relative inside temperatures were recorded. The food compartment temperature in the electric refrigerator was 33° F and in the gas refrigerator was 37° F. As a result, the temperature control on the electric refrigerator was changed to No. 7 in order to reach equal food compartment temperatures.

Both refrigerators were then run continuously to 9:30 a.m. May 20, when the food compartment temperature on each box was 36° F. It was decided that both boxes had reached a point of temperature equilibrium at this time and the actual 48-hour test was started.

Starting at 9:30 a.m. the top doors on both boxes were opened twice for 10 seconds on each opening and the bottom doors were opened five times for 10 seconds on each opening. The time of openings, room temperatures, and compartment temperatures were recorded on each opening. Meter readings were recorded cumulatively at the termination of openings at 9:44 a.m.

Starting at 10:15 a.m. four bottom door and one top door openings were made on each box and the same data as in the previous opening were recorded.

At 11: a.m. and at 11:30 a.m. one top and one bottom door opening was made on each box.

At 12:30 p.m. there were two top door openings and five bottom door openings.

At 1:15 p.m. one top door opening and four bottom door openings were made.

At half-hour intervals starting at 1:45 p.m. a total of five top door and five bottom door openings were made.

Starting at 4:15 p.m. two top door openings and five bottom door openings were made, and at 4:30 p.m. all doors were sealed until 9:30 a.m. the next day, May 22, when the same schedule of door openings was followed. At 4:30 p.m. May 22, the doors were again sealed and the test was concluded at 9:30 a.m. May 23.

Throughout the test 15 top door openings and 30 bottom door openings

Data and conclusions

The following data were obtained:

Gas Refrigerator

Date	Time	Hours	Cu Ft	Cost
5/20/53	9:30 a.m. to 4:30 p.m.	7	13.3	$ 0.0086
5/20/53	4:30 p.m. to 9:30 a.m.	17	31.7	$ 0.0207
5/21/53	9:30 a.m. to 4:30 p.m.	7	13.8	$ 0.0090
5/21/53	4:30 p.m. to 9:30 a.m.	17	32.7	$ 0.0212
Total		48	91.5	$ 0.0595

Electric Refrigerator

Date	Time	Hours	Cu Ft	Cost
5/20/53	9:30 a.m. to 4:30 p.m.	7	0.720	$ 0.0144
5/20/53	4:30 p.m. to 9:30 a.m.	17	1.840	$ 0.0368
5/21/53	9:30 a.m. to 4:30 p.m.	7	0.730	$ 0.0146
5/21/53	4:30 p.m. to 9:30 a.m.	17	1.840	$ 0.0368
Total		48	5.130	$ 0.1026

On the basis of the data obtained the following conclusions are made:

Fuel cost per month

Gas ..... $\frac{48}{730}$ hrs x $0.0595 = $0.90

Electric ..... $\frac{48}{730}$ hrs x $0.1026 = $1.56

Ratio electric cost to gas cost

$$\frac{\$1.56}{\$0.90} = 1.73$$

The author takes instrument readings for recording cost and performance data in the gas vs electric refrigerator tests. Between the boxes is the recording thermometer used in the closely controlled study.

were made on each box each day for a total of 90 door openings in two days on each box. Each door opening was made for an interval of 10 seconds.

The data and conclusions obtained from the test are shown in the box.

The temperature recording charts on which room temperature and refrigerator unit temperatures were recorded show the following results:

Unit Temperature Above Room Temperature	
Gas on low flame	26° F
Electric with motor off	20° F
Gas during defrost cycle	34° F
Electric during defrost cycle	29° F

The bottom or food compartment temperatures of both the gas and electric refrigerators were about the same, both having minimum temperatures of 34° F and a maximum temperature of 44° F in the gas refrigerator against 42° F in the electric refrigerator.

However, the electric refrigerator freezing compartment showed consistent lower temperatures than the gas refrigerator freezing compartment.

Gas minimum	4° F
Electric minimum	3° F
Gas maximum	8° F
Electric maximum	4° F

The lowest temperatures in the freezing compartment of the electric box were observed at the time the door was opened immediately after the motor had stopped. Due to the "on"-"off" operation of the electric box the temperature differential in the freezing compartment was 7° F, whereas the throttling type operation in the gas model resulted in only a 4° F differential.

From the starting of both refrigerators to the start of the 48-hour test it was observed that the electric refrigerator reached its control point temperature in less time than the gas box.

It was also observed that maximum gas flow in the burner of the gas refrigerator occurred only during the defrost cycle, and the minimum gas flow never reached its lowest point. In other words, high flame was below possible maximum flow of 2.8 cu ft per hour and low flame was above possible minimum flow at 0.2 wc pressure.

Although both refrigerators were operated throughout this test under identical conditions, we believe that the fuel costs of $0.90 per month for gas and $1.56 for electricity can only be considered from a ratio standpoint of 1.73 to 1.00 in favor of gas. On refrigerators of the same size such variables as room temperature, amounts of food stored, number of ice cubes made, amount of frozen deserts made, number of door openings, length of time of door openings, etc., would result in appreciable variations in costs from those obtained in this test.

Unit temperatures in the gas refrigerator above room temperatures are not as high as commonly thought.

Heat is given off by the electric refrigerator.

Temperature recovery in the electric compression type refrigerator is more rapid than in the gas absorption type.

Due to the throttling type operation of the gas refrigerator less variation of inside temperatures occur than in the on-off type operation of the electric refrigerator.

Slow opening, quick closing of cylinder-operated valve achieved with check valve

AT THE Silver Gate generating station in San Diego, Calif., the San Diego Gas & Electric Co. has incorporated an unusual feature into the operation of its cylinder-operated Nordstrom valves.

To avoid erratic burner conditions, gas must be introduced to the company's No. 3 steam generating unit slowly, yet some means of rapid shut-off is necessary. This unit, a 575,000-lb/hr B & W boiler, was installed in 1950. Eight 6-in. Fig. 1989 Nordstrom valves were installed on gas lines to the unit's boilers. Each valve is cylinder-operated by 95 psi air pressure controlled by a ½-in. 4-way valve.

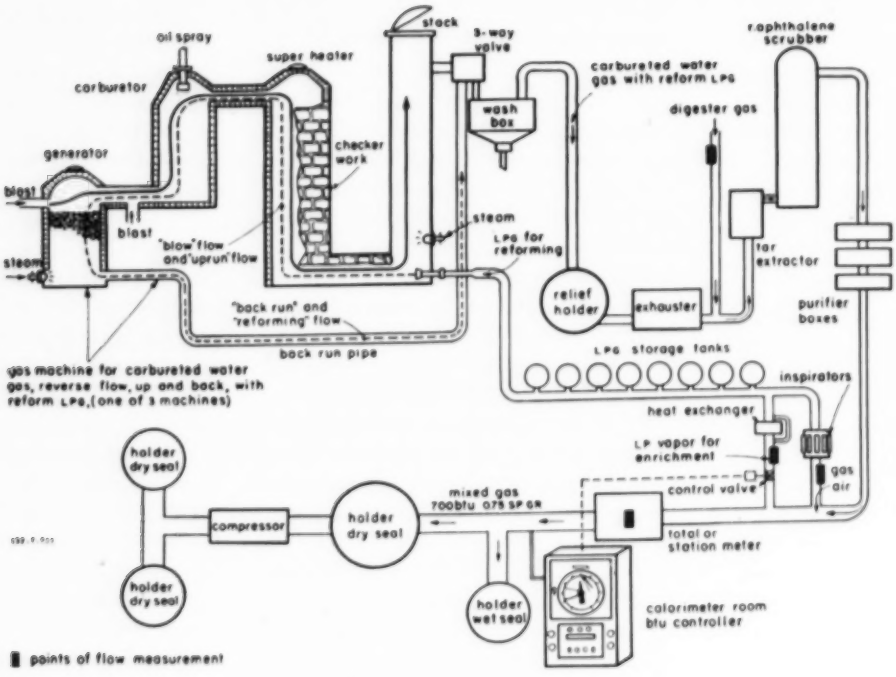
The problem confronting the engineers at the Silver Gate station was to devise a method whereby the Fig. 1989 Nordstrom valves could be opened slowly yet close at a normal speed. They approached the problem by controlling the air exhaust from the cylinder as the valve was being opened to regulate the speed of the piston movement to the opening time required. A fixed orifice in the exhaust line from the cylinder would result in controlled piston movement in both directions. This would slow valve closing as well as retard its opening, so a method of removing the restriction from the exhaust line when closing the valve had to be devised.

This was accomplished by drilling a check valve with a No. 60 drill, .04-in. and locating the check valve in the exhaust line from the cylinder so that it closes when the Fig. 1989 is being opened, and thus restricts the exhaust from the cylinder slowing the piston movement. When the valve is being closed the check opens allowing air to be introduced into the cylinder at full flow. The piston movement within the cylinder is regulated so that the Fig. 1989 valve is closed in approximately one-half of the 20 seconds required to open, and thus provides the slow opening and rapid closing conditions required.

View of 6-in. Fig. 1989 Nordstrom valve with cylinder control. At top of photo on line from cylinder is check valve, drilled to control piston speed.

The eight 6-in. Fig. 1989 Nordstrom valves pass a maximum of approximately 640,000 cfh of natural gas at pressures from 1 in. for pilot to 11 psi full flow, dependent upon the boiler fuel control system. Gas from high pressure mains outside the plant is regulated within the plant to 19 psi and delivered through a 10-in. main to a second regulator where it is reduced in pressure to 13 psi and the line expanded to 12 in. From this 12-in. line the takeoffs through the Nordstrom valves are established.

This article is adapted from the March-April issue of the *Flow-Line*, published by Rockwell Manufacturing Co.



Complex mixture of five gases he

BECAUSE of severe operating conditions and the fluctuating nature of the make-up gases, the Waterloo, Iowa, gas manufacturing plant of the Iowa Public Service Co. has the dubious distinction of being one of the toughest and most contrary city gas manufacturing operations in the country. Utilizing at present five basic make-up gases to produce a 700 Btu mixture, the Waterloo plant has grown like Topsy, with new gases being introduced over the course of the years to increase gas production and enrichment. Prior to 1952, Btu control was strictly a manual operation, and the results, although fair, considering the many processing variables, were far from satisfactory. With the installation of a new Caloroptic-electronic Btu control system, the heating value of the final mixed gas was held closer than was ever believed possible. Moreover, not only were some of the consumer complaints reduced, but the equipment paid for itself in a few months' time.

Complex operation

An idea of the extreme complexity of the operations at the Waterloo plant is evident in the following brief description of the component gases for the final 700 Btu mixture:

Component gases

(1) *Carbureted Water (Blue) Gas*—It usually constitutes over three-fourths of the volume of final mixture. This gas is produced in three gas machines which burn high grade bituminous coal. The oil employed for carburetion varies from fuel oil mixtures to petroleum wax.

(2) *Digester (Sewer) Gas*—This gas, purchased from the city sewage disposal plant, varies widely in flow rate from 80 to 300,000 cu ft per hour, depending upon seasonal make-up. Also, over 60% of this gas comes from a large packing plant whose output, and therefore gas-producing potential, cycles radically every day. Sewer gas makes up roughly 10% of the final finished gas mixture.

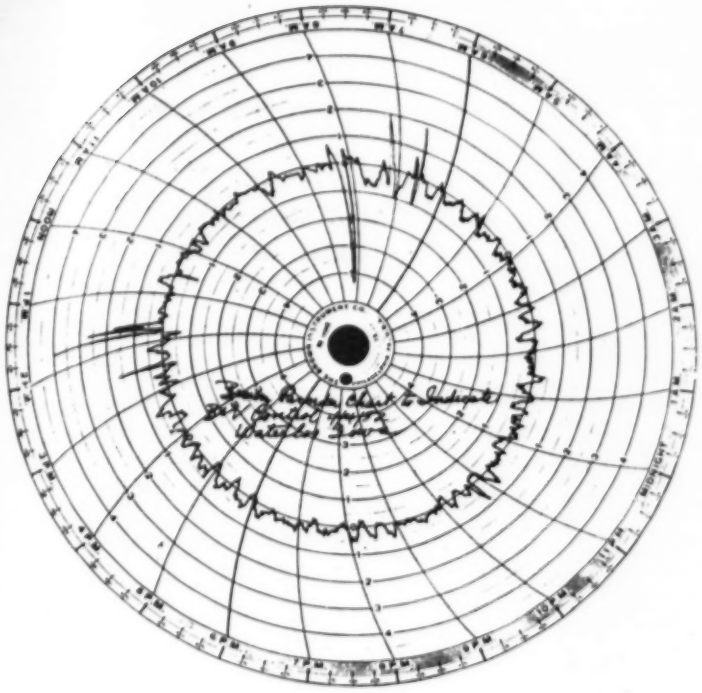
(3) *Liquefied Petroleum Gas (LPG) Vapor*—Constituting about 6% of the finished mixture volume, LPG vapor is the final additive to the mixture for enrichment purposes to maintain the desired 700 Btu/cf value. Ordinarily, butane is used as the LPG, but propane is occasionally employed.

(4) *Reformed Liquefied Petroleum Gas (LPG)*—In addition to the carbureted water-gas produced at the gas machines, reformed LPG is also manufactured. This make-up fraction comprises about 5% of the finished gas volume. This gas has a low gravity and requires LPG gas air to raise the gravity to 0.75.

(5) *Liquefied Petroleum Gas Air*—This constituent is used only in minute quantities for adjusting the specific gravity of the final gas.

Additional complications

The demand side of the process produces additional complications because of the wide variance (from 1.2 to 5.6 MMcf per day) of the total distributed gas. Heat treating and similar gas-fired processes at one large industrial user (about 30 MMcf per month nominal) play a major role in establishing total gas demands. Thus, the process is clear-



From the five make-up gases mixed as shown in the flow diagram on opposite page, the controller at Waterloo directs the production of city gas of almost constant Btu value, as shown on the recording chart at immediate left.

...helt 700 Btu's by electronic controller

ly stamped with complexity, variability and contrariness.

Operations at the Waterloo plant are more completely and easily described by reference to the schematic flow diagram. Carbureted water (blue) gas, plus reformed LPG, is produced in one Semet-Solvay reverse flow and two U.G.I. machines. The resultant carbureted water-reform LPG gas output is blended with digester (sewer) gas of 0.82 specific gravity from the municipal sewage plant. After cleansing operations, where the tars, naphthalene, ammonia and other impurities are removed, proper gravity is maintained by the addition of gas-air from a battery of four inspirators. The mixture is finally enriched with LPG vapor to reach a 700-Btu base. Flow metering equipment for accounting purposes is employed as noted in the diagram.

Master controller

Final control of the heating value of the mixture is regulated by the master controller, the Connelly Caloroptic Btu controller, located in a separate specially built control building. The sampling line for the controller is located downstream from the total or "Station" meter. Briefly, the Caloroptic controller actuates a valve on the LPG vapor line to hold the final mixture's Btu content within certain fixed tolerances.

Checking operation of Connelly Caloroptic Btu controller.

The Connelly Btu control system employs a series of electric, photoelectric and electronic devices to translate the heating value of a gas into a continuous electrical signal for recording and control purposes. A gas sample is continuously passed into the Caloroptic detecting element, which comprises a pressure regulator, a calibrated burner tube, and Photronic* cell, as illustrated.

Calibrated burner tube

Operation of the calibrated burner tube is based on the principle that the volume of air required for perfect combustion of a gas is a direct function of the heating value (Btu content) of that gas. The calibrated burner tube is equipped with a micrometer type adjustable sleeve which varies the amount of primary air passed through the tube. The tube is set with considerable yellow in the flame at the control point and, then, changes up or down in this

*Registered trade-mark, the Weston Electrical Instrument Corp.

View of Connelly Caloroptic Btu controller, including close-up of Caloroptic sensing element.

value produce the control action.

Caloroptic operation is such that the gas passage is from the sampling line, through the pressure regulator, to the burner tube, where it is mixed with a precise quantity of air and finally burned. A Photronic cell focused on the resultant flame generates a certain microamperage, depending upon the luminosity of the flame. This generated microamperage thus varies in proportion to the flame luminosity (flame luminescence depending on the completeness of combustion), which in turn varies with the heating value (Btu) of the gas mixture. Since the adjustable sleeve on the calibrated burner is set to zero, the Caloroptic with 700-Btu on the recording calorimeter, any increase or decrease in the Btu value of the manufactured gas will result in a different colored flame, which in turn results in varying current output of the Photronic cell.

Intensity measured

Output of the Photronic cell is fed into an ElectroniK potentiometer recorder-controller mounted on the front of the cubicle, as illustrated. Intensity of the input signal is measured with a shunted potentiometer circuit in the controller which provides both instantaneous indications and a permanent record together with control action. Four mercury switches in the controller, together with a specially designed interrupter circuit, provide either short or long pulses to the motorized gate valve on the LPG vapor line. These pulses occur once a minute when the interrupter circuit is energized. Length of the pulses depends upon the distance of the recording pen from the set point.

It is important to note that excellent results were achieved even though modulating type interrupted control with a non-throttling gate valve was utilized in order to take advantage of existing equipment. Proportioning or throttling type control with reset action which provides valve movement proportional to the deviation of the measured variable from the desired value, and automatically compensates for load changes would give even closer control of this process.

The operation is not entirely automatic because a manual operation of burner adjustment is occasionally required. These changes are necessary only when there are major changes in the characteristics of the gas being made, such as when a different water-gas machine is started at a different Btu level, or a very marked change occurs in the digester gas pumping rate.

Referring to the chart record from the ElectroniK recorder-controller, note the excellent results obtained. Each of the major divisions on the 5-0-5 chart normally represents 10 Btu's. (The 5-0-5 evenly divided graduations are entirely relative and merely indicate deviations from the "0" zero center control point.) In the illustration, the large swings of the pen from the zero control point are due to the lag in correcting the Btu of the gas back to 700 after pumping rate changes. These lags would not materially affect gas to the city as gas mixes in a huge storage holder before distribution.

Wide swings in Btu

A study of the chart will show that approximately six times during the day wide swings in Btu occurred. In each case there was a marked pumping rate change. The biggest swing in Btu was shown as about 15 Btu; this happened at 8 a.m. and again at 1:45 p.m., when there was a change in pumping rate from 20 to 44 in. in the morning and in the afternoon from 48 to 24 in.

There are many significant facts and some truly remarkable results emanating from the Caloroptic controller installation at the Waterloo plant of the Iowa Public Service Co.

From a concrete dollars and cents standpoint, the Btu controller is a proven success, as the system undoubtedly more than paid for itself in less than six months.

Moreover, the economics of the accuracy of the heating value are so important to one industrial concern that they take their own Btu checks twice daily. With a monthly usage of well over 30 MMcf, one or two stray Btu's represent a very large sum of money.

Intangible benefits

Economic advantages of the unique Connelly Btu control system are still secondary to the intangible benefits derived from improved customer-company and operator-company relations. And, of course, customer satisfaction is the most important benefit of all.

Finally, from an instrumentation and control standpoint, the Caloroptic control system is truly remarkable because of the exceptional control job with equipment which has a relatively small initial cost when compared with some of the elaborate systems.

This article appeared originally in *Instrumentation*, published by Minneapolis-Honeywell Regulator Co.

A better gas range is possible—now!

AGA lab demonstration, led by W. B. Kirk, chief research engineer, proves that basic, important improvements to increase salability are now ready.

THE same growing conviction of the gas industry's failure to devote enough energy to the competitive appliance development and sales situation that prompted the AGA and GAMA to join hands and organize the Action Program for Gas Industry Development is evident in a current activity of the AGA. It's a demonstration, before selected audiences made up of utility executives and range manufacturers, in which are dramatically shown new test range models incorporating new improvements that have sprung from the research laboratory but are not as yet incorporated into production models.

"This project," it was explained at the first demonstration last month in Cleveland, "is another approach to the problem of improving the conceptions of utilities and manufacturers as to what may be done with a domestic gas range."

The purpose of this PAR sponsored project is to discover improvements now possible in gas ranges and to reduce the time lag between the discovery of these improvements and their appearance on the market. In meeting this objective, working models of desirable features have been and are being developed for demonstration to interested utility company representatives and to manufacturers within the gas industry. The project aims for the attainment of some of the goals of the Gas Industry Development Program. This demonstration is in the nature of a first trial run. If this demonstration technique is successful with ranges, it will be followed in other PAR research projects.

The improved features shown in these first working models are aimed at making gas ranges better than competitive equipment: (1) cool, if not absolutely cold ranges for cooler kitchens, (2) instantaneous ignition or re-ignition of top burners at any input rate, (3) unsurpassed heating speeds plus high efficiency, (4) greater cleanability, (5) precision control of the 1000 heats possible with gas top burners plus very low turndown heats, (6) a fast, large area, golden-glow broiler, and (7) positive elimination of explosion hazards in a precision controlled oven.

The following descriptions of equipment are excerpted from the demonstration talk.

Right front burner

Utilizing a nickel-sized-head, which has been widely used for many years on some industrial type burners and more recently on double-duty range top burners, this single-duty burner gives a broad span on precision heats with good efficiency, flexibility for satisfactory performance on all city gases and L. P. gas-air mixtures, elimination of primary air adjustment, reliable instantaneous ignition or re-ignition at any heat setting from its own individual standing pilot, and small size and simple construction for ease of cleaning.

Low heat setting is approximately 350 Btu per hour; high heat inputs can exceed 16,000 Btu on natural gas with stable flames and satisfactory combustion. It has no air shutter to get out of adjustment. Efficiency rating at 9000 Btu per hour, 51%.

In operation, the slot burns a ring of flame or "halo fire" just below the main ports, thus causing flame retention. Despite its small size, it delivers fast high heating, and can be throttled to low "keep-warm" heats.

Right rear burner

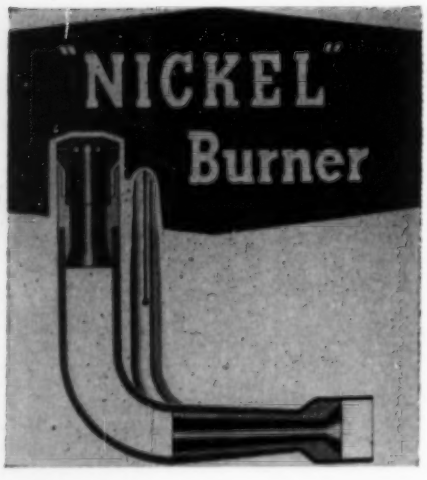
With only eight ports, this burner has a minimum turndown rate of less than 300 Btu per hour on Cleveland (AGA Lab) natural gas. This low controlled heat will hold coffee at 170-180° serving temperature. Ignition features similar to those on right-front burner give instant lighting, with separately charged ignition port and carry-up slot lighting from an adjacent 50-Btu standing pilot. Separately charged ignition port is supplied with gas from low heat side of a conventional double-duty valve. Satisfactory performance has been obtained on all city gases, peak load gases, and on 3200-Btu butane at a nominal rate of 7200 Btu per hour. It has no air shutter. Rated at 9000 Btu per hour on natural gas, its efficiency is 49.2%.

The two design ideas exploited: a small number of ports allow low turndown, and controlled flame pattern under utensil raises efficiency, decreases heat losses.

Top section pilots

Two pilots lighting the two right burners are identical. Being low-Btu type to keep the range "cold" yet give fast, reliable ignition, they permit the use of one per burner and eliminate slight time lags and possible mechanical defects of flash tubes. Heat input is less than 50 Btu; four top pilots would total less than 200 Btu per hour, which is less than a single conventional pilot. This is one-half the heat given off by an idle person; less than one-fourth that given off by an active person. Small shields prevent outages from light drafts; and the pilots have withstood spillover and acoustical tests.

For ease of adjustment, a small valve for complete shutoff of the pilot is supplemented with a compressible filter.

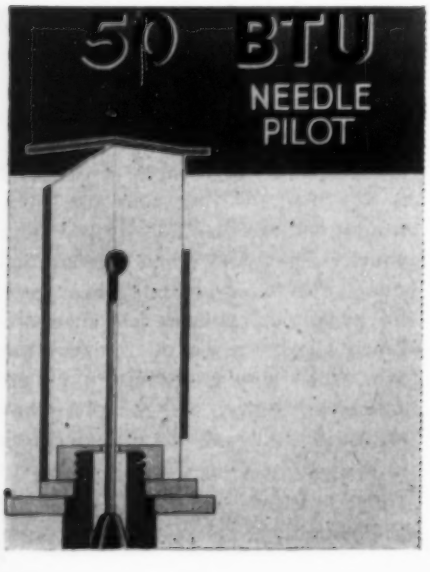


An adjustment screw squeezes or releases pressure on the filter to control gas flow rate.

The main part of these pilots is a hypodermic needle. The gas is burned on the tip of the needle so that the flame is no larger than the bead of a small hat pin. The needle tip becomes red hot and acts as a flame stabilizer.

The gas flame remains relatively unchanged with variations in line pressure. The variation between ½ normal test pressure (3.5 in. water) and 1¼ normal test pressure (8.75 in. water) is almost indiscernible.

The ignition system on the left of the top section is also of new and improved design to provide for a cooler top section and less heat loss to the kitchen. A common pilot for the two burners on the left operates in conjunction with short flash tubes to ignite the front and rear burners. Input rating is 100 Btu per hour on natural gas, and this pilot operates satisfactorily at any gas pressure between 1¼ and ½ normal test pressure. The flames burn yellow at 1½ normal pressure, but no carbon is deposited. To date, no cracking of gas has been evidenced. The pilot burner consists of a stainless steel tube flattened and sealed at one end with a hole drilled through one flat side. The pilot is mounted horizontally with the port facing downward. Its flame has no primary air and burns so that it envelopes the portion of the tubing near the port, rendering it hot. This causes the pilot flame to be quite stable at very low heat inputs.



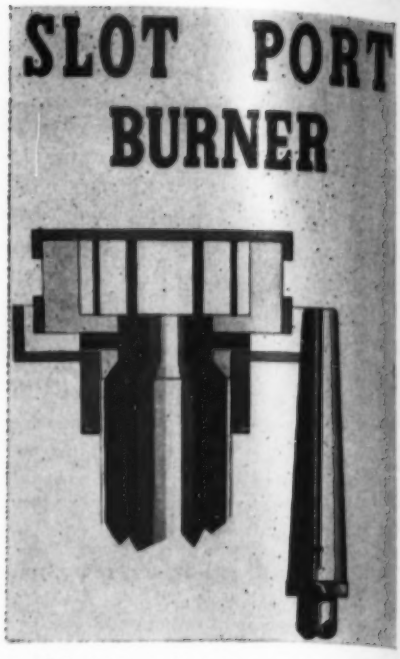
To illustrate how this low heat pilot can be used effectively for fast, reliable ignition, the conventional giant burner at the left front has been modified to illustrate one way of having a separately charged ignition port and carry-up slot. As with the experimental burners, it is possible to light the burner quickly regardless of whether it is at full heat input or at a reduced input (including the minimum operating rate of 1200 Btu per hour). Also, the burner and carry-up slot will re-ignite in case of outage at any input. The original ignition charge port and carry-up slot have been blocked off from the gas supply to the main burner head. Gas is now supplied directly to the ignition charge port through a separate orifice. The separate orifice is connected to one outlet of a conventional double-duty valve, with the main burner head being supplied in the usual manner from the other outlet of the valve. The usual delay of waiting for sufficient gas to pass through the burner mixing tube and burner head to the ignition port is eliminated.*

Incidentally, the efficiency of this modified giant burner is 49% at 12,000 Btu per hour input, and goes up to 56% when the input is reduced to 9000 Btu per hour. However, in our opinion, the minimum possible heat input or turndown rate of 1200 Btu per hour is rather high.

Top section valves

As already indicated, one simple expedient for providing faster ignition or re-ignition at any valve setting is through the use of a direct and full gas supply to the burner ignition port. This is exemplified with the valves for the left front and right rear burners. As soon as these valves are moved from "off" to any "on" position, a full stream of gas flows through the low heat side of the valve to the burner ignition port. The other side of the valve supplies gas to the burner head. There is no real

*This general principle of ignition was developed at the Laboratories and publicized in Bulletin 50 in 1948, but has apparently not been used.



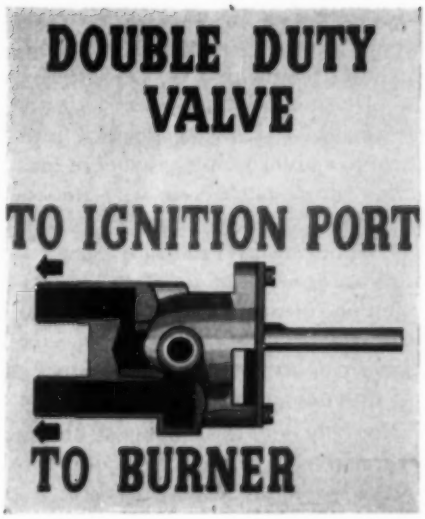
modification of these contemporary valves, but they are employed to serve a different purpose than usual. Total valve handle rotation available is 230°, although the first 170° of this rotation has no effect on controlling gas input rate to the single-duty burner but simply acts as a seal or supplies gas to the ignition port. To overcome the long turning between ignition and burner "on" positions, these valves would have to be modified by repositioning openings in the valve plug.

To provide for precision control of low heat inputs to single-duty top burners, the valve used with the left rear burner was developed at the Laboratories. With an effective rotation span of 250°, it allows a better selection and reproduction of the low heat inputs a housewife really needs. The principle of operation is simply to rotate one orifice past another, so that full heat input is obtained when the two holes are completely matched. It differs from a conventional valve in permitting full pressure at the orifice in any valve position, thus the wide control range. In a conventional valve, the only control is obtained when the port opening is smaller than the orifice.

The burner used to illustrate this valve's performance is a commercially available single-duty burner of recent design with primary emphasis on simple construction and flexibility of operation with relatively high port loading. This unit was selected because its unique port shape and design enable its use on all city and peak load gases, while still retaining good efficiency and low turndown rate on a single-duty burner head. Its flame retention principle is one possible method of achieving some of the objectives illustrated with our experimental burners for improved appearance, cleanability, and effectiveness of heat application with precision control. As the burner is now mounted with an adapted ignition system, it has a minimum heat input of less than 450 Btu per hour for low temperature operations and an efficiency of 42.5% at full heat input. Incidental investigation with respect to a lower burner heat input rating, aeration bowl design, and burner position has indicated that this burner has an efficiency

of 54.2% at a full heat input rating of 7000 Btu per hour. This means that heat lost to the kitchen at this lower input rate would be less than two-thirds that lost at 9000 Btu per hour, and almost the same amount of heat would go into the cooking load. A discussion of this general subject is included in supplementary material.

Another possibility for improving heat control is shown with the needle-type valve for the right front burner, which has a total rotation of 270° with an effective span of 200°. By modifying the taper of the moving pin, changing the thread pitch for its travel, and relocating the rotation stop, we have approached the type of control desired with a single-duty contemporary valve. Then, to provide for the separate ignition port gas supply featured with the



double-duty valves, a small bypass was added external to the valve body.

A third new method for controlling top burner heat is represented separately. This product of an independent inventor has the desired characteristic of linear heat control and makes "number cooking" possible. The important working part is a small brass sleeve with a wedge-shaped opening which is gradually opened as more heat is desired.

Valves capable of giving the precision control exhibited here would, of course, be somewhat more expensive than conventional types. However, we believe this added expense is justified.

Muffle-type oven

Advantageous features of this experimental oven are: (1) fast preheat and low heat loss to the kitchen, (2) excellent baking characteristics, (3) very low oven maintaining temperature, (4) cool surfaces, (5) small burner representing savings on materials of construction, (6) low input

automatic pilot, (7) adaptability for inclusion in a complete gas range without any special problems providing a separate (high) broiler is used, and (8) explosion-proof design.

This muffle-type oven is heated by the passage of hot gases from the burner up around the right and left sides and back across the top of the oven compartment. No combustion products enter the oven baking compartment. With a nominal input rate of 21,000 Btu per hour to the small circular experimental burner and 6% CO_2 in the flue gases, we have cut flue losses to the kitchen by 15%, as compared with many typical fresh air ovens. As a "heat miser," the average oven surface temperature is 35% less than that of several typical fresh air ovens. The 100 Btu per hour pilot

heats the oven to 98° F on an 80° day. Obviously, safety, economy and speed of operation, and cooler operation are prime achievements in this design.

Speed of preheating to a balanced oven temperature of 400° F is only 5½ of the 10 minutes permitted by requirements. This oven gives uniform baking and browning of standard test cakes, pumpkin pies, and buttermilk biscuits. As an example, these cakes, which have been baking during this demonstration, illustrate the degree of uniform browning that may be expected.

The burner used in this demonstration may be turned down so that, with its automatic pilot, a minimum bypass rate of 1000 Btu per hour is obtained. This low rate makes it possible to maintain an oven's temperature of only 190° F on an 80° day. This is really maintaining a low oven temperature!

We tried to blow up this oven with both natural and manufactured gases. Delayed ignition at either the burner or flue outlet caused no damage, and the oven door stayed closed throughout the gamut of lean to rich explosive mixtures. The severest reaction obtained with flash-back from the flue only tended to open the combustion chamber door a fraction of an inch. We feel that this is a vitally important safety development.

The experimental burner was designed for city gases with flexibility on peak load gases, as well as for good turndown characteristics. It has not been perfected for use on liquefied petroleum gases, although we feel this can be done. Its physical size is only half that of typical oven burners.

Another important feature of this oven is that its performance is not particularly dependent upon the type of burner used. A contemporary bar burner was modified by reducing the number of ports and substituted for the experimental burner. It was also rated at 21,000 Btu per hour. We were able to increase CO_2 in the flue gases to 8.6% with good combustion, and thereby decrease flue losses to the kitchen by 30.7% as compared with typical fresh air ovens. Primarily because this burner had to be mounted lower in the combustion chamber than the first experimental burner, preheating time to 400° F was increased to 6½ minutes, which is still reasonably fast. The acid test of baking cakes yielded uniformly browned products which were well within requirements limitations. Of course, this conventional type burner and its pilot could only be turned down to 1730 Btu per hour, so that minimum oven temperature was 250° F in an 80° room.

Broiling compartment

A new or little used element has been introduced in broiling with this unit—a golden flame burner. The objectives here include: (1) a fast, uniform broiling heat over a wide area, (2) effective use of heat to minimize heat losses to the kitchen, (3) a broad span of heats down to and including a low pilot heat with a simple burner, and (4) smokeless broiling with luminous or radiant-type flames for psychological effect.

As an example of its even heat distribution, bread placed about 2¾ in. below the ports browns evenly over the usable pan area within approximately 3½ minutes from a cold start.

Not only does this smokeless broiler take merely 10 of the 16 minutes permitted by requirements to preheat our test thermocouples to 530° F above room temperature, but its radiant flames also start to broil meat as soon as it is turned on. Whether you broil 'em thick or thin—with the radiant flame, meats remain tantalizingly rare and juicy in the center! For example, from a cold start a ¼-in. thick steak

placed 2 in. below the ports requires about 10 minutes, while a 1-in. thick steak reaches the desired degree of "doneness" in 17 minutes. Most important of all, heat released to the kitchen is materially reduced to about two-thirds of that normally released by some contemporary broilers. For technical substantiation of this low heat loss, CO_2 in the flue gases of this broiler is increased from a typical concentration of about 3.5% to 5.6% and the burner has a rather low heat input rating of 14,000 Btu per hour.

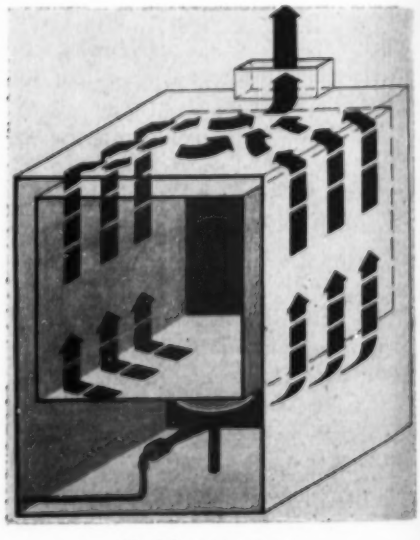
With the usual glass wool insulation, and asbestos stripping to minimize metal-to-metal heat conduction, a fairly cool exposed surface is obtained. For example, we found that the metal door handle was only 14° above room temperature when the approval requirements test was applied. The door

reached 57° above room temperature.

Both the oven and broiler doors are equipped with gasketing materials to prevent leakage of hot gases or cooking vapors that might deposit unsightly stains. Although we are not sure such door gaskets or seals will last the life of the range, they have reached the point of development where they offer interesting possibilities. We have used some materials intermittently for several months without damaging them.

We have consistently aimed at lower exterior surface temperatures on this equipment to minimize the possible hazard of burning by personal contact and to reduce heat losses to the kitchen.

The simple, small burner is only one twenty-fourth conventional size and can be turned down to 160 Btu per hour. This offers an enticing possibility for using the burner as its own standing pilot, particularly if a thermal sensitive device is adapted to it to shut off the gas in the event of flame outage. This burner, first developed in the series, operates satisfactorily on city gases and most peak load gases, but has smoky flames on straight butane or 1400 Btu butane-air.



Muffle-type oven.

Why ConEd integrates its gas and electric operations

By H. R. SEARING • Consolidated Edison Co. of New York

THE combination company—that is, one that sells both electricity and gas and, in our case, steam—makes it possible for the public to get its utility services at the lowest possible prices. That should be so, obviously, because integrated operation of utility services ought to be more efficient than separate operation. We have found it to be true for this metropolitan territory we serve, with its many problems which are peculiar to New York.

For many years we have integrated our operations. One step was to bring about corporate mergers and consolidations. As rapidly as we could, we merged subsidiary companies. You will remember that Consolidated Gas took over New York Edison and changed its name to Consolidated Edison. The Brooklyn, Queens and Westchester, and Yonkers companies were merged in due course. When the New York Steam merger, now pending before the public service commission, comes through—and we expect that to be authorized very shortly—there will be only one subsidiary left, the Consolidated Telegraph & Electrical Subway Co.

As far as we are concerned, we have never contemplated separate operations. That is why we did not have any special provisions in our present first and refunding mortgage to facilitate the separation of the gas and electric business. Now with 20-20 vision of hindsight we are sure that, as far as this company is concerned, we were right in that decision.

We think of ourselves as being in the business of producing and distributing energy. This energy may be in the form of kilowatts of electricity, cubic feet of gas, or pounds of steam. Basically, Consolidated Edison sells Btus. The suggestion has been made, facetiously, that we change the name from Consolidated Edison Co. to Consolidated Energy Co.

We believe the combination company makes for the greatest economic and social good. We think that the customer is better off, for he will generally end up with the service that is best fitted to his needs, for the particular job he wants done. But he still has his freedom of choice.

I think I am right in saying that no other combination company in the country has integrated its operation as fully as we have. This starts with production and goes right up and down the line.

Integration of our production facilities was the most complex problem. The equipment and techniques for making electricity and gas are, of course, quite different. The necessity for this integration was given a big impetus through the prospect of obtaining natural gas, for that meant we would have surplus help on the gas-making side of the business.

The big job in turning gas production people into electric production people, and vice versa, was one of training. We went into extensive on-the-job training and special schools. Our faith in the flexibility of our supervisors and men has been well justified.

Today we have a production department responsible for the production of electricity, gas, and steam. We have one vice president in charge of all production. This afternoon when you visit the new Astoria plant you will see our new electric station standing alongside the gas plant. On our program today is the man who is general superintendent of all operations at Astoria, both electric and gas. One of Con Edison's largest electric generating stations is operated today, and has been for many years, by a man who was a former supervisor of the Consolidated Gas Co.

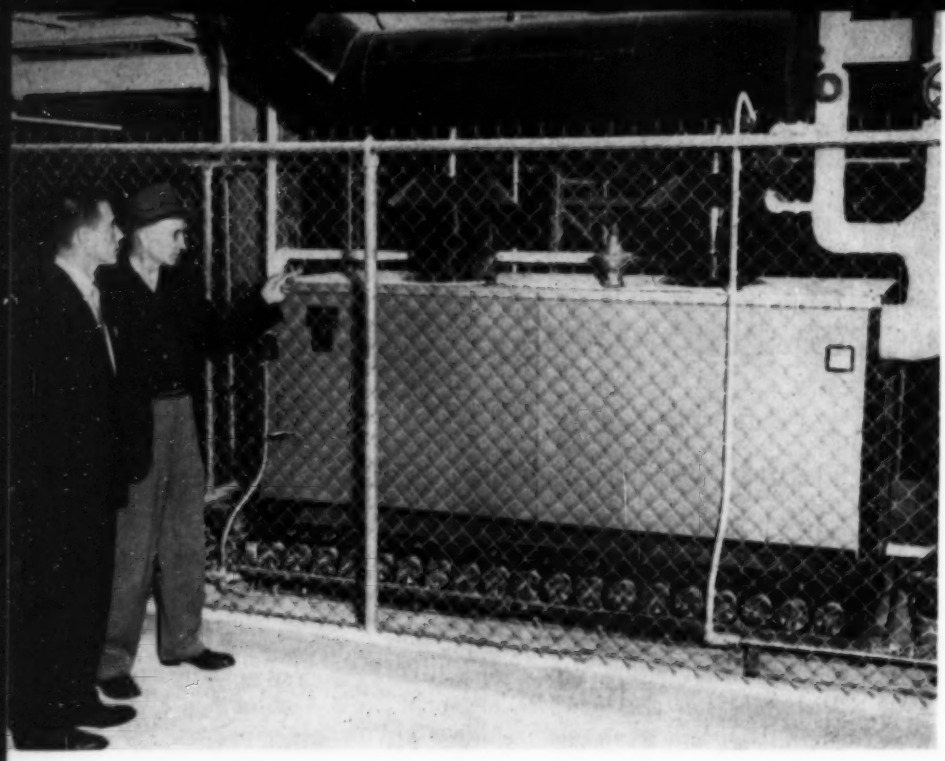
This integration extends throughout the company. Our departments are set up according to function. A transmission and distribution bureau does engineering for the electric, gas, and steam systems. Our mechanical engineering department designs machines and equipment for whatever jobs they are to perform. All drafting is done in one bureau. Our rates—electric, gas, and steam—are all handled by one group, as is the case with accounting, advertising and so on.

Customers have their gas and electric meters read by the same man. The bill shows what is owed us for both gas and electricity. In connecting a new building to our lines, the same crew may lay both gas and electric conduits in a single trench. Public relations are improved because street openings are coordinated by one group.

Our new business representative, when he consults with the owner of a building to determine his needs, will develop a recommended gas and electric layout. If it is a large new building on the steam mains, he probably will recommend steam for air conditioning.

The integration has been gradual. Our employees have not been upset, for the process has been geared to the normal attrition—retirements, resignations, and other outages. Generally speaking, our people are better workers and far more versatile workers than they were before.

This article is excerpted from a talk given by President Searing recently when a group of utility analysts were guests of ConEd.



Two reasons for enclosing National gas boilers within heavy chain-link fencing: 19 gas boilers are installed on roofs of restrooms, and fencing prevents falls to the floor below by any maintenance worker; and unauthorized personnel are prevented from getting too close to the heating system. Looking at the installation are Ralph A. Mumert, National Radiator, and Tom Henry, who was mechanical superintendent for the designer and builder.

Boilers installed on restroom roofs heat 40-acre aircraft plant

WHEN 19 gas-fired boilers are installed on the roofs of restrooms in 40 acres of industrial buildings, and efficiently operate on either straight natural or propane-air gas, it is only proper to recognize this heating system as one of the most unusual to be completed in the past year.

About two years ago a building site of 160 acres was found at Pomona, Calif., 40 miles east of Los Angeles. Construction was started on an $80 million plant for the production of guided missiles.

Cross-country shipment

Carloads of gas boilers were shipped across the country by the National Radiator Co., timed to the progress schedule of the $1½ million heating and air conditioning system. This entire manufacturing facility, operated by Consolidated-Vultee Aircraft Corp., is completely air conditioned.

The largest building in this plant has an 18-acre floor area. It is heated and domestic hot water is provided by 10 19-W-55 gas boilers. Each of these AGA approved boilers has a net rating of 1,212,300 Btu per hour which is equivalent to 8080 sq ft of hot water radiation.

Nine other National gas boilers are scattered throughout four other buildings. All boilers are installed on the concrete roofs of restrooms that are strategically spaced throughout 40 acres of Convair buildings.

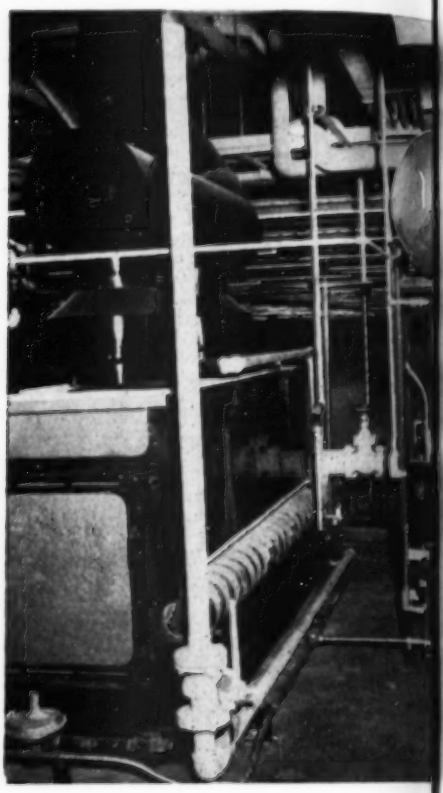
The roofs of the fully enclosed restrooms are about 10 ft above floor level. Six inches of reinforced concrete, plus 2 in. of magnesia block, separate the gas boilers from the ceilings of the rooms.

Water at 180° F comes from the boilers and is delivered to coils in the air conditioning system. These coils are in fan houses on the roofs of the plant buildings. The whole air conditioning system is automatically operated and is designed to function within a 2° temperature differential.

Adequate hot water

Heat exchangers and storage tanks installed adjacent to the boilers assure an adequate supply of domestic hot water for use in the restrooms beneath the boiler installations.

One of the 19 gas boilers supplying heat and domestic hot water in the Pomona, Calif., guided missile plant operated by Convair.



National Radiator took particular care in assembling these 19 boilers so they would efficiently consume either straight natural gas or, in an emergency, a propane-air mixture. The vital importance of the guided missile production made necessary the prompt availability of a propane-air supply if for any reason there was interruption in natural gas transmission.

All the gas boilers were on-the-job tested and approved by engineers from the American Gas Assn. testing laboratory.

New Products and Trade Literature

To secure further information on products or new literature, simply fill out the coupon and mail, indicating by number the information or literature needed.

1 Plug Valve

The connecting of valves to steel pipe with grooved-end couplings is made possible with the introduction of a new grooved-end version of Rockwell Manufacturing Co.'s standard two-bolt yoke type Nordstrom semi-steel lubricating plug valves.

With this method, a tight, permanent connection can be made in minutes and lines may be dismantled as often as necessary without damage to the pipe or grooved-end coupling.

The new wrench-operated valve has a pressure rating of 175 psi.

Rockwell Manufacturing Co.

■

2 Disposal Unit

CaloricStove Corp.'s new gas-fired disposal unit features the Calor-a-Tred, a foot pedal for opening the loading door, and the Calor-a-Set, which provides the householder with a convenient adjustment to meet any disposal need. The disposal may be installed in kitchen or basement, so long as its 6-in. flue is connected to a chimney.

The unit stands slightly more than 36 in. high. Other features of the Caloric Disposer are heavy-gauge steel construction of the dehydration chamber; main top and loading door of acid-resisting porcelain; glass lining; and durable Nupon finish on the cabinet.

Caloric Stove Corp.

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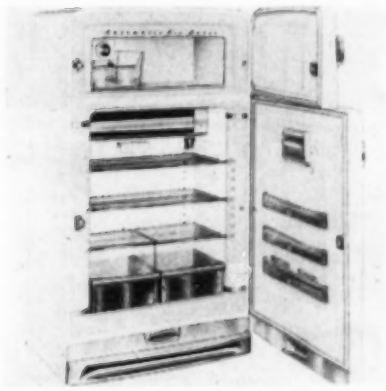

3 Gas Refrigerator

Servel's 1954 line of gas refrigerators is headed by Model 1149-G, its largest gas refrigerator with a total volume of 10.7 cu ft. The two-door model features the automatic Ice-Maker (shown at left in freezer compartment), and automatic defrosting.

Other features include door shelves, butter container, egg storage, and two vegetable containers. The freezer capacity is 2 cu ft; shelf area, 17.8 cu ft.

Servel Inc.

4 Temperature Transmitter

A high grade dial thermometer, combined with a Penn pneumatic transmitter, makes up the new Penn indicating temperature transmitter. The unit, suitable for outdoor unprotected installation, may be mounted on 2-in. pipe, wall bracket or panel. The dial thermometer has a mercury filled thermal system for temperature ranges from —40° F to 1000° F and provides an evenly graduated 8-in. diameter scale. A wide variety of bulbs and sockets can be furnished. The standard air output range of the transmitter is 3 to 15 psig. Other ranges are also available.

The instrument eliminates the need for long lengths of capillary tubing or additional indicators. Any number of receivers can be operated by a single transmitter making it possible to indicate, record, or control temperatures at several different locations simultaneously. The transmitter has the "worm plate" construction which reduces the number of piping connections to a minimum. Both the nozzle and restriction are "jeweled." It is possible to clean the restriction while the unit is in service.

Penn Industrial Instrument Corp.

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5 Gas Range

In celebration of its 75th anniversary, Hardwick Stove Co. has introduced a new Hardwick 75 series of gas ranges. Several new features are offered, including Super EconoMatic 100% safety shutoff for all top burners as well as the oven.

Super EconoMatic models are identified by three buttons on the control panel. Additional features incorporated as standard equipment include electric clock with four-hour timer, non-glare top light, and appliance outlet. The oven and broiler unit are all porcelain with a heavy chrome broiler pan.

Hardwick Stove Co.

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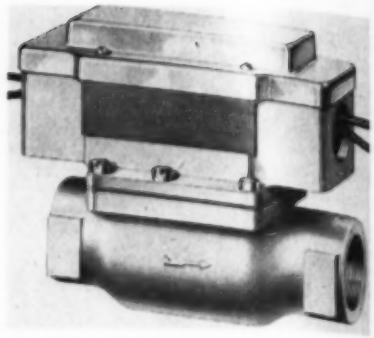

6 Control Valve

A new main control valve has been introduced by Milwaukee Gas Specialty Co. that uses a rotor operating in a magnetic field instead of a solenoid. The new control called the Actrol valve, is said to eliminate a great deal of noise. The first model available in the new line is a low-voltage model of ¾-in. size with a capacity of 170,000 Btu/hr with manufactured gas and 252,000 with natural.

Installation is simple; the transformer is built into the control and can be turned end for end to facilitate wiring. The valve body can be mounted in any desired position through 360° around the centerline of the valve. It closes against a synthetic rubber seat.

Milwaukee Gas Specialty Co.

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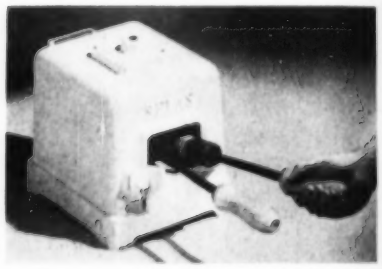
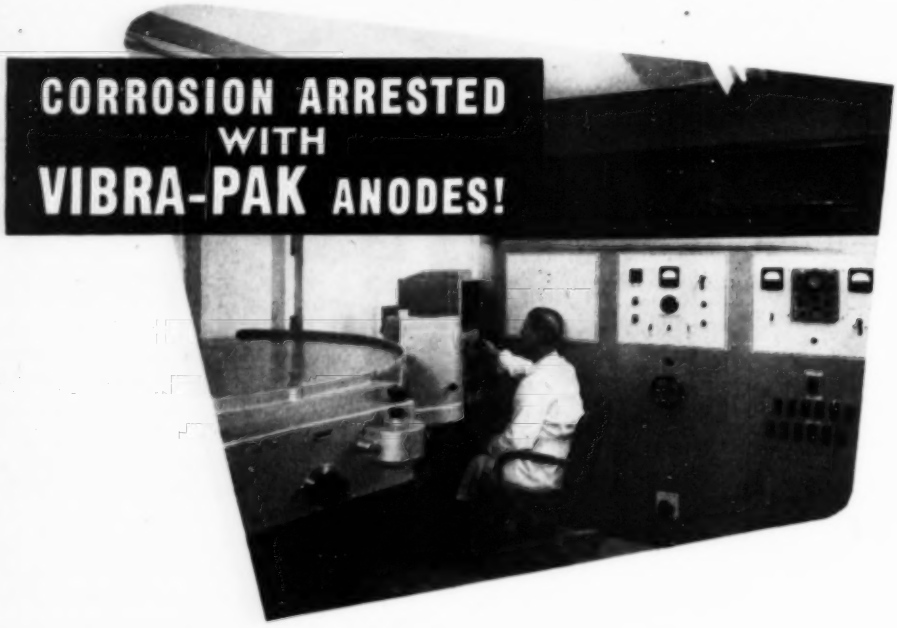


7 Soldering Furnace

A new gas-fired soldering furnace with a radiant burner will heat, in less than eight minutes, two 4-lb irons from room temperature to 900° F, or one 4-lb iron to 1200° F, with a heat input of 9100 Btu per hour. Other features of the furnaces, designed and built by Selas Corp., are simplified maintenance, longer life of soldering coppers, and provisions for operators' comfort.

Burner is located so that mechanical shock and flux corrosion damages are held to a minimum. Refractory hearth is easily removed and cleaned. The die pressed furnace lining can be installed quickly should replacement be needed. Heating is accomplished without flame impingement, yet the



A major pipeline company corrosion engineer gives this authentic case history of how, after using many different corrosion control practices, he switched to VIBRA-PAK anodes with these results!

"Endeavoring to find an anode which would give us maximum efficiency and longer life, we tried Standard Magnesium Corporation cylindrical anodes and found they returned more current per pound of *magnesium and received more life per anode.*

I'm sold on Vibra-Pak high purity magnesium anodes, made to spectrographic analysis."

—VIBRA-PAK anodes are spectrographically analyzed for metal purity . . . *your guarantee of longer service life!*

—a new, patented spiral core won't separate from anode . . . *positive contact is assured!*

—and remember, VIBRA-PAK means the anode is compacted and centered in the backfill through shipping, handling and placing it in the hole.

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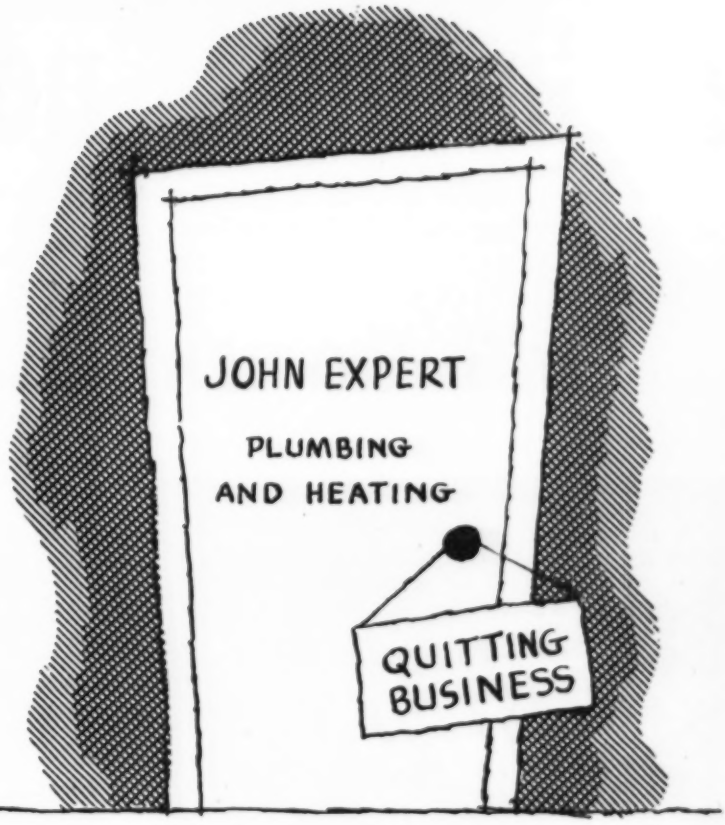
Standard Magnesium Corporation
TULSA, OKLAHOMA
Pioneers of: SPECTROGRAPHICALLY ANALYZED ANODES AND CYLINDRICAL ANODES

NUMBER 1 IN A "HOW-TO" SERIES

HOW TO CURE A CUSTOMER HEADACHE



• Following John Expert's example is one way. But the *sure* cure for customer dissatisfaction due to inefficient water heater operation is to install water heaters with Titan Tankmaster controls.

TANKMASTERS are built to exacting engineering standards and are laboratory tested to insure safe, dependable, accurate and economical operation.

TANKMASTERS are original equipment on some of the finest water heaters on the market.

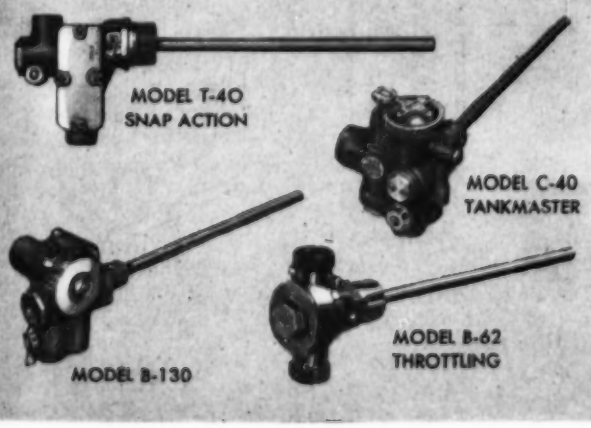
TANKMASTERS have proved themselves in many thousands of domestic water heater applications by virtually eliminating post-installation service.

TANKMASTER performance is guaranteed by one of the oldest manufacturers of water heater controls in the nation. Our many years of experience in this field is your assurance of unsurpassed quality.

These are some of the many reasons why we KNOW Titan Tankmasters should be original equipment on the water heaters you sell. We'd like the opportunity to have our representative tell you more about the many advantages in selling Titan-equipped appliances. Clip the coupon *below* for our latest complete-line catalog of controls and service instructions.

THE TITAN VALVE & MANUFACTURING CO.
9913 ELK AVENUE • CLEVELAND 8, OHIO

TITAN



THE TITAN VALVE & MANUFACTURING CO.
9913 Elk Avenue, Cleveland 8, Ohio

☐ _____

☐ _____

Name _____

Company _____

Title _____

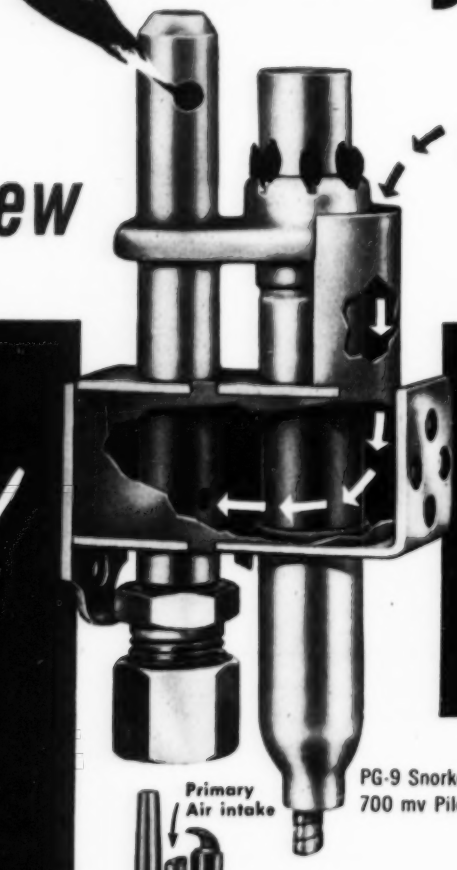
Address _____

City _____ Zone _____ State _____

no linting no lazy flame

with the new

Snorkel type

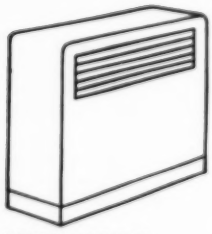


PG-9 Snorkel
700 mv Pilot Generator

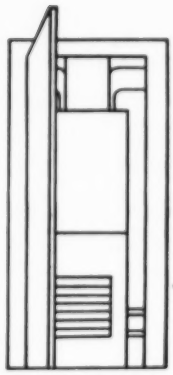
POSITIVE INCINERATOR PRINCIPLE... DIRT-FREE PRIMARY AIR THROUGH SNORKEL INSURES BLUE FLAME PILOT STABILITY ON ALL GAS-FIRED APPLIANCES

26S Pilot Burner

260S Pilot Burner



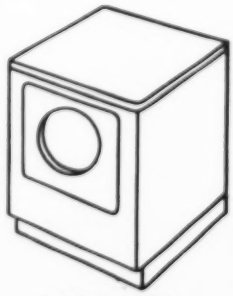
CONSOLE HEATER



CLOSET HEATER

IDEAL FOR ABOVE-THE-FLOOR INSTALLATIONS

WALL HEATER



CLOTHES DRYER

General Controls' Snorkel Pilot Burners and Pilot Generators incorporate proven design principle. The primary air passes under pilot flame which incinerates dirt and lint. Elimination of these foreign particles insures a crisp and stable blue flame. Primary air is mixed with gas at pilot orifice in a sealed mixing chamber which is cool, thus preventing cracking of the gas. Pilot and thermopilot flame ports are large diameter to prevent plugging. PG-9 Snorkel Pilot Generators, 260S and 26S Pilot Burners are available for all General Controls thermocouple-operated safety and self-powered control systems.

GENERAL CONTROLS

PLANTS IN: GLENDALE, CALIF., BURBANK, CALIF., SKOKIE, ILL.
FACTORY BRANCHES IN 37 PRINCIPAL CITIES
SEE YOUR CLASSIFIED TELEPHONE DIRECTORY

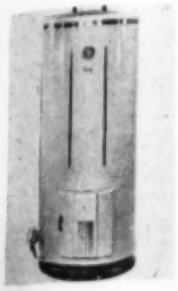
Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls for Heating, Home Appliances, Refrigeration, Industrial and Aircraft Applications.

soldering copper is surrounded by fully burned gases which eliminate oxidation of the copper.

Selas Corp. of America

■

8 Water Heater



A. O. Smith's new commercial water heater is a 65-gal. model that has been designed to generate high temperature (180°) water for commercial purposes and, at the same time through an adjustable thermostatic mixing valve, furnish general purpose hot water.

For the first time, glass-lining is employed in the commercial line of Smith-Burkay water heaters. The B-65 incorporates Heetwall and Ceramitron construction, and may be applied not only to commercial establishments such as small restaurants, but may be used in large homes.

A. O. Smith Corp.

■

Trade Literature

9 Color Sound Film

A 16-mm color sound film to serve as a training medium for the sizing and marketing of Burkay commercial water heaters has just been released by the Permaglas division of the A. O. Smith Corp. Designed especially to assist dealers and distributors in conducting commercial water heater sales meetings, the film, "Burkay, Your Winning Way," runs 25 minutes. Together with speakers, the film will be available for association or technical meetings.

A. O. Smith Corp.

■

10 Air Heater Bulletin

Peabody Engineering Corp. has published a seven-color bulletin describing in both print and detailed flow diagrams the operation of Peabody air heaters. Typical applications of the heaters, which are used in process industries for spray drying, liquid concentrating, rotary drying, and petroleum refining, are included.

Peabody Engineering Corp.

■

11 Trenching Equipment

Cleveland Trencher Co. has issued a new bulletin describing its complete line of trenching equipment. Inside spread of the four-page bulletin has been arranged to permit a simple, quick comparison of the digging capacity and specifications of Models 92, 95, 110, and 140, the standard machines for city and suburban utilities and pipeline trenching from 10 in. to 30 in. wide and up to 5½ ft deep. Text briefly describes specific advantages, typical job applications, and special construction features of each model.

Cleveland Trencher Co.

■

12 "DirectoRod Guide"

A 32-page "DirectoRod Guide" has been published by the Eutectic Welding Alloys Corp. Over 300 types of metal joining operations are covered. The booklet contains over 40 illustrations of practical applications taken from case history files and 12 pages of charts. It is divided into sections covering the various base metals, each with a chart of applicable electrodes, alloys and fluxes.

Eutectic Welding Alloys Corp.

■

13 Furnace Bulletin

The Allcase batch type controlled atmosphere furnace of the Surface Combustion Corp. is described in a new bulletin. The six-page illustrated folder completely details

YOU GET
fast Service
on An-Spec Quality
Magnesium anodes . . .
• Quality spectrographically analyzed anodes.
• Fast Service
• Custom manufacturing for special problems.
• Consulting and engineering service.
When you dump your cathodic protection problems in our lap . . . we get your anodes to you in record time. Our reputation for taking care of customers in a hurry is one of our biggest assets. You can depend on our consulting and engineering service to solve your anode installation problems.
ANODE SPECIALISTS
AN·SPEC
PIPE LINE Anode CORPORATION
25th WEST AVENUE AND SAND SPRINGS ROAD
P. O. BOX 996
TULSA, OKLAHOMA
DISTRIBUTORS:
Pipeline Supply Company
2230 Magnolia Street
Birmingham, Alabama
Crose Pipeline Equipment Company
858 Wilson Avenue
Newark, New Jersey
Crose-Curran, Ltd.
11102 Jasper Avenue
Edmonton, Alberta
Pipeline Supply Company
912 West 11th
Houston, Texas

the features of the standard and heavy duty sizes and presents detailed construction drawings and photographs of typical process applications.

Surface Combustion Corp.

■

14 Instrument Bulletin

Its line of specialized instruments and gauges is featured in a new condensed bulletin just published by F. W. Dwyer Manufacturing Co. Included are instruments for measurement of combustion, draft, pressure, flow, vacuum, CO_2, smoke, velocity, static pressure, pressure differential, temperature, etc. Each type is illustrated and described.

F. W. Dwyer Manufacturing Co.

■

15 Temperature Control Bulletin

Temperature control systems are the subject of Educational Bulletin F6149 issued by Wheelco Instruments Div. of Barber-Colman Co. Sections are devoted to the selection of sensing elements and their correct use, instrument industry control terminology, and rules to follow in selecting the proper method of temperature control for process characteristics or reactions. In addition, a complete explanation is contained of the various types of control systems.

Wheelco Instruments Div., Barber-Colman Co.

■

16 Industrial Products Catalog

A new edition of Johns-Manville's 40-page industrial products catalog offers essential data on the following products: insulations, refractory products, asbestos cement pipe, packings, gaskets, electrical products, frictional materials, roofing, siding, flooring, partitions, and ceilings. Photographs, diagrams, and text have been revised and brought up to date.

Johns-Manville.

■

17 Pyro-Optical Catalog

Pyrometer Instrument Co. has just published its new Catalog No. 85, presenting detailed information on the company's Pyro-optical pyrometer. In addition, the bulletin contains technical information on the principles of optical pyrometry, illustrations of applications, and other data.

Pyrometer Instrument Co.

■

18 Pump Bulletin

A new 16-page bulletin on air-powered controlled-volume pumps, which are used to solve low-capacity flow control problems, has been issued by the Milton Roy Co. It contains a graphic presentation of pump operating principles; capacity-pressure and air-consumption tables; and examples of Milton Roy-engineered chemical feed systems.

Milton Roy Co.

■

19 Soldering Iron Bulletin

A new soldering iron furnace capable of heating two 4-lb irons from room temperature to 900° F or one iron to 1200° in less than eight minutes (with a heat input of only 9100 Btu per hour) is described in a bulletin from the Selas Corp. In addition to descriptive information, the four-page bulletin presents operation and performance data.

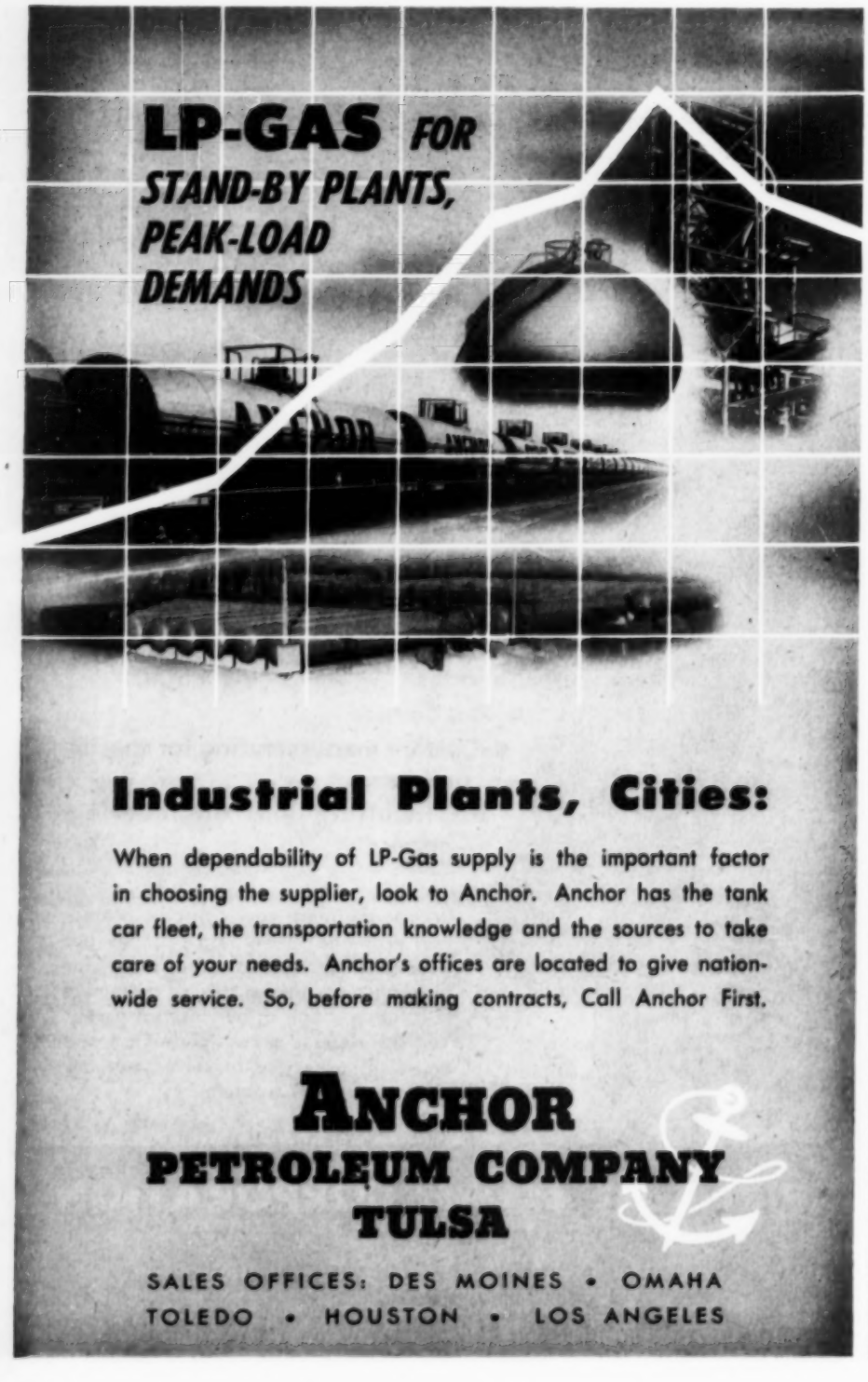
Selas Corp. of America

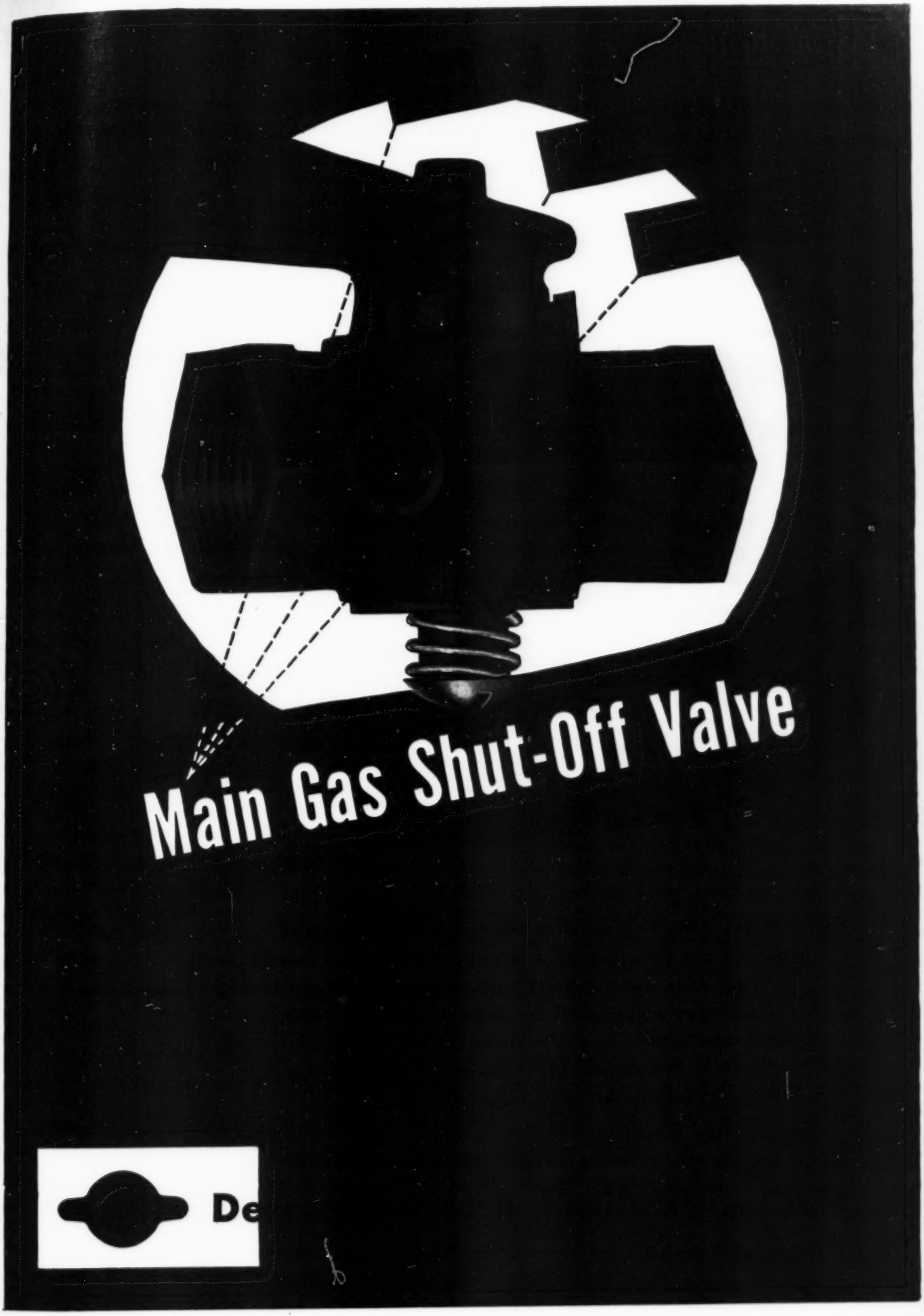
■

20 Fire Extinguisher Bulletin

Redi-Matic automatic sprinkler-type fire extinguishers, which have been designed to permit quick and economical installation of fire protection directly over fire hazards, are the subject of a new two-page bulletin issued by Stop-Fire Inc. Descriptive details both on operation and construction of the Redi-Matic extinguisher are included.

Stop-Fire Inc.


LP-GAS FOR STAND-BY PLANTS, PEAK-LOAD DEMANDS
Industrial Plants, Cities:
When dependability of LP-Gas supply is the important factor in choosing the supplier, look to Anchor. Anchor has the tank car fleet, the transportation knowledge and the sources to take care of your needs. Anchor's offices are located to give nation-wide service. So, before making contracts, Call Anchor First.
ANCHOR
PETROLEUM COMPANY
TULSA
SALES OFFICES: DES MOINES • OMAHA
TOLEDO • HOUSTON • LOS ANGELES


Main Gas Shut-Off Valve
De

Thermally Thinking

Continued from page 34

ceive less than 3% of the vote at first submission, less than 6% on the second vote, and less than 10% on the third vote.

Northwest decision by March ?

The Federal Power Commission has been asked to decide by March which of the two rival applicants will get its approval to pipe natural gas into the Pacific Northwest, but that's no reason to believe that the commission will agree to a deadline on hearings, as it never has before.

The request was made by C. R. Williams, president of the Pacific Northwest Pipe Line Co., which has asked the FPC to rule on the evidence taken at the hearings—now almost two years old—before waiting for recommendations by a hearing examiner.

It is a fact that a ruling in March, if it finally settled the case, would permit the successful applicant—either Pacific Northwest or its Canadian rival, Westcoast Transmission Co.—to complete construction in time to take gas to the West Coast by the 1954-55 heating season.

New reasons why.. Sherman Power Diggers give you More for '54

NEW "STRESS - DESIGNED DIPSTICK, BOX-TYPE CONSTRUCTION
NEW REINFORCED BOOM, EXTRA BEARING SURFACE FOR LONGER PIN AND BEARING LIFE
NEW DOUBLE-BRAID HOSES FOR MAXIMUM DEPENDABILITY
NEW SWING CONTROL SYSTEM GIVES BETTER CONTROL, SMOOTHER ACTION
NEW REGULATOR VALVES FOR SMOOTH, POSITIVE CONTROL OF LIFT AND CROWD CYLINDERS

Important new features, combined with advantages proven by thousands of users, add up to more production for your digging dollar! The Sherman Hydraulic Power Digger is designed and built for that wide range of job requirements beyond the economical use of hand labor and below the efficient use of larger equipment. Yes, between the smallest and largest jobs, you'll find there's always a place for your Sherman Power Digger! Ask your nearby Sherman dealer for an on-the-job demonstration today. Write for free literature, Dept. J10.

Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN

Designed, Engineered and Manufactured jointly by SHERMAN PRODUCTS, Inc., Royal Oak, Mich. WAIN-ROY CORPORATION, Hubbardston, Mass.
Patent No. 2,303,825. Other patents pending.

Matters for Management

Seal wins in court test

Customers have as much reason to rejoice as do manufacturers and utility companies over last month's decision of the U. S. district court in San Francisco which enjoined a water heater manufacturer from affixing the AGA seal of approval to non-approved appliances.

It was one of the first court tests of the certification trade mark provisions of the Lanham Act and as such is an important milestone in the development of safety and consumer protection.

The defendants, Jud Whitehead Heater Co., Judson J. Whitehead Jr., the Electric Kitchen Appliance Co., and the Hynes & Cox Electric Corp., all of whose activities in the gas business are carried on principally in California, were found by the court to have "repeatedly used, affixed or displayed the certification trade-mark (of the American Gas Assn.) upon gas water heaters manufactured, produced, assembled, or distributed by said defendants, which gas water heaters have not been tested or approved by the plaintiff."

The court also found, among other things, that the defendants had made or sold untested and unapproved water heaters "which did not comply with the safety standards and requirements of the plaintiff and which were unsafe, inefficient and unfit for use by the ultimate consumers or users of said gas appliances."

Not only were the defendants forbidden to use the AGA seal or reproductions or imitations of it on unauthorized appliances, and to surrender material and advertising displaying the seal, as well as plates and molds used to

Performance that only 75 Years of Experience could Produce

HARDWICK 1879 75 1954 GOLDEN JUBILEE

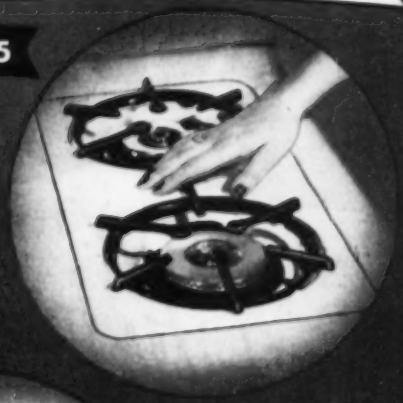
HARDWICK 75 GAS RANGE

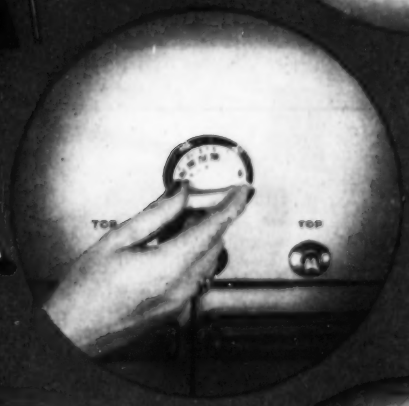
with *Super* EconoMatic

HARDWICK 75

Cool

Pilot is so small and so fully shielded that you'll never know it's there.





Convenient

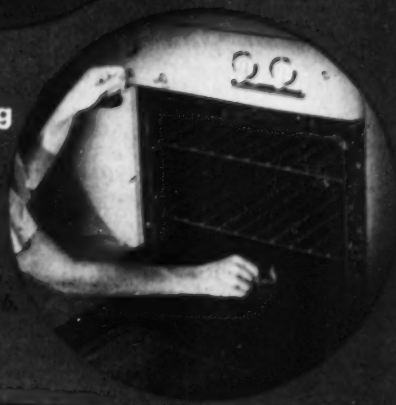
Automatic oven lighting is now offered on HARDWICK Apartment Models as well as on full-size ranges.

The World's Safest Range!

The new HARDWICK 75 sets new standards of safety and performance. Every burner lights automatically . . . yet no gas can escape from any burner or pilot, even if the pilot is out and burner is left "on" for hours or days. Super EconoMatic automatically cuts off the gas supply to top burners or oven and pilot, when the pilot is extinguished for any reason. In addition to outstanding safety, Super EconoMatic offers many other exclusive features to attract attention of customers everywhere.

Instant Relighting

At range times when range has been out of use, pilot relights instantly when you light oven with match.



Nationally Advertised in *Ladies' Home Journal, Better Homes and Gardens and McCall's*

Plus newspaper mats, TV and radio spots, and other hard-hitting selling aids.

HARDWICK *Automatic Gas Ranges* • HARDWICK STOVE COMPANY, CLEVELAND, TENN.

make them, and to remove seals from existing stock; but they were also ordered to permit certain AGA inspection procedures. The association may now inspect the plant at any time. Furthermore, it is to be furnished with names of all outlets and a list of recipients; and the defendants were ordered to notify recipients of the heaters that the appliances were not entitled to bear the seal.

That would seem to be about as far as any court could go in protecting the good reputation of the seal—and the life and limb of the gas using public.

Layoff . . . with no regrets

A new peak of perfection has been reached in employee relations when a man you've laid off praises you publicly for the way you did it.

That's just what happened recently at Geo. D. Roper Corp., according to word from the Rockford, Ill. range manufacturer. But in this case, it wasn't just one man—it was 450 of them, who were cut off the rolls when the Army chopped off nearly half its orders for 105-mm shells, which the company has been producing for national defense.

That's more than one-fifth of the total 2200 employees at Roper.

When the company received the shattering news of the cutback, executives immediately went to work to ease the pain. They first obtained a 30-day extension, giving their promise of production stretchouts in the future to level out the resultant overproduction; then they issued three-weeks notice to the unfortunate 450. The announcement was scheduled to squash rumors before they could get started. Plant foremen were told first, then union representatives, then after the remainder of the plant personnel had been notified, the newspapers were informed and a letter was sent out by President Stanley Hobson to employees' families explaining the situation.

Other Rockford companies were called by Roper's job interviewer, who compiled a list of available jobs, and within a week more than 100 men had been placed. The union was called upon to help ease the transition of 900 workers to other jobs in the company. Twenty-one oldsters past retirement age were laid off, but the company arranged for part-time jobs for many of them to supplement their pensions.

Not everyone was able to find another job immediately. But so smoothly and understandingly was the job handled, and so well did the company cooperate with the union, that the president of Local 39 himself paid the company this high compliment;

"I don't know of any plant where more has been accomplished as far as employee relations are concerned."

ARCCO
ARCCO NEVER-DRY PEN
Writes for Months
REPLACES OTHER MAKES • USES REGULAR INKS
Regardless of pulsations or other causes of ink failures this new Never-Dry Pen will make clean and complete records. Ink supply lasts for several months without refilling reservoir. Capillary tube from ink bottle placed in instrument case feeds pen with continuous flow. Closed system sealed from atmosphere prevents clogging and dirt accumulation.
Weight of pen is constant at all times thus insuring extreme accuracy. No slopping or dripping. Stainless steel construction—no corrosion. When ordering, specify make and type of recording instrument.
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RECORDING CHART CO.
3113 E. 11th St. • Los Angeles 23, Calif.
$6.00 each Net
Send for quantity prices
SEND FOR BULLETIN No. 115

Abstracts

SECONDARY AERATION OF ATMOSPHERIC GAS BURNER FLAMES, PART 1—PRELIMINARY EXPLORATION OF METHODS—By James C. Griffiths. (American Gas Assn. Laboratories Research Report No. 1204 on project DA-2-GU.) Exploratory methods used in the investigation of secondary aeration of one single port bunsen-type burner and several multiple port burners are given in this first progress report. Data are developed which relate required secondary aeration for satisfactory combustion to such factors as input rate, primary aeration, burner design, and directing of secondary air into the burner flames by means of baffle plates and secondary air passageways.

These data indicate that with the single port burner, primary aeration has considerable effect on required excess air, but that directing the flow of secondary air into the

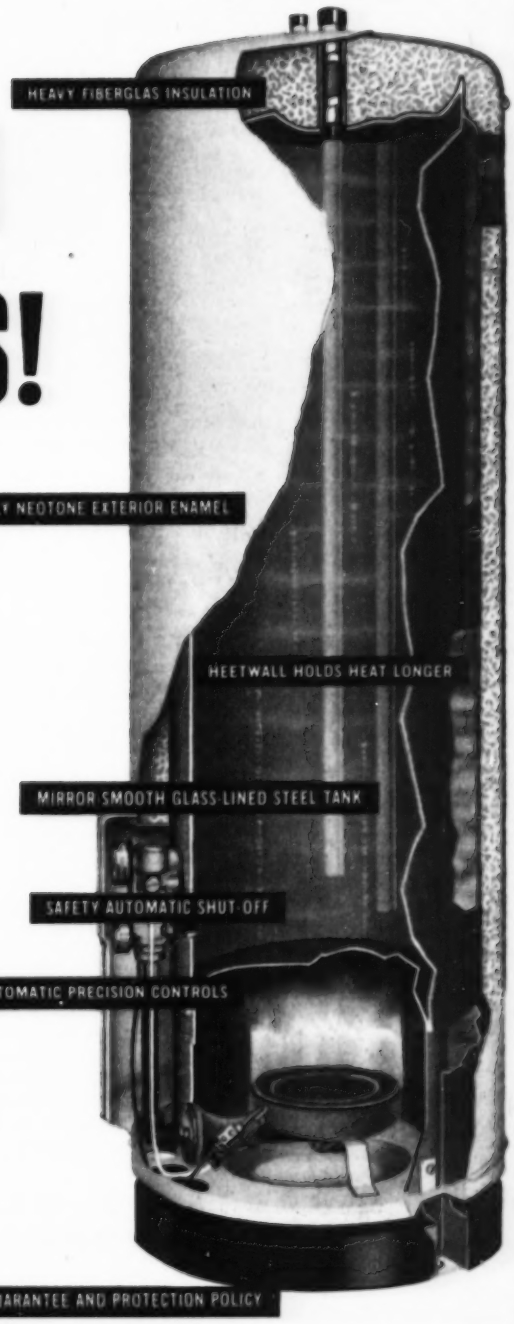
Sell the most-wanted water heater in America!

Permaglas

A SIZE FOR EVERY HOME

THE ONLY WATER HEATER

PROVED RUST-PROOF IN OVER 2 MILLION HOMES!



An ordinary water heater rusts away each minute of the day...

Every homeowner whose ordinary water heater rusts away is an immediate and HOT prospect for an A. O. Smith *Permaglas* automatic WATER HEATER! Its glass-lined steel tank will *never rust* . . . will end customer hot water problems forever!

Prepare for Profits NOW . . . be ready to replace these rusty water heaters with *Permaglas*!

Best of all, a *Permaglas* costs no more than an ordinary water heater. And feature for feature, a *Permaglas* is tops.

We have the facts to back these statements, write
Dept. G-254, Kankakee, Ill., Permaglas Division

International Division: Milwaukee 1
Licensee in Canada: John Inglis Co., Ltd.

Electric Models 30 to 80 gallons capacity

There's only one *Permaglas* and it's made by

A.O.Smith
PERMAGLAS DIVISION

burner flames has little effect under combustion chamber conditions imposed thus far in the work. Recirculation of combustion products into the burner flames appeared to be the determining factor for satisfactory combustion with the multiple port burners. In these cases, the use of secondary air baffle plates to prevent recirculation of combustion products into the base of the flames permitted the use of far less secondary air.

PHYSICAL-CHEMICAL PROPERTIES OF METHANE-ETHANE MIXTURES—By O. T. Bloomer, D. C. Gami, and J. D. Parent. (IGT Research Bulletin 22, a PAR plan activity of the AGA.) Liquid-vapor phase equilibria, gas phase pressure-volume-temperature relationships, and saturated liquid and vapor density data for the methane-ethane system have been determined by a detailed experimental investigation with specific mixtures of methane and ethane.

The liquid-vapor phase equilibrium data were determined by a study of the dew and bubble point pressure-temperature relations of eight mixtures of methane and ethane. Experimental runs were made in a heavy-walled glass cell immersed in a cryostat. The cell contents were stirred with a steel ball which was raised and lowered magnetically. The dew and bubble points were determined by direct visual observation, and the critical region of each mixture was carefully investigated. The range covered was from 50 psia through the critical region; the lowest temperature was —210° F, while the highest was +90° F, the critical temperature of ethane. The highest pressure at which the liquid and vapor can coexist is 998 psia.

Pressure-temperature, temperature-composition, and pressure-composition diagrams have been prepared from the dew and bubble point data. Equilibrium vaporization ratios were determined from these diagrams and are presented in tabular form. It is estimated that the phase equilibrium data are reliable to ±2 psi or ±0.2° F, whichever is greater. The data have been compared with values determined from the "Kellogg" equilibrium constant charts over the range 100-600 psia; the agreement is only fair and a need is indicated for correcting the Kellogg charts, particularly for ethane at low temperatures.

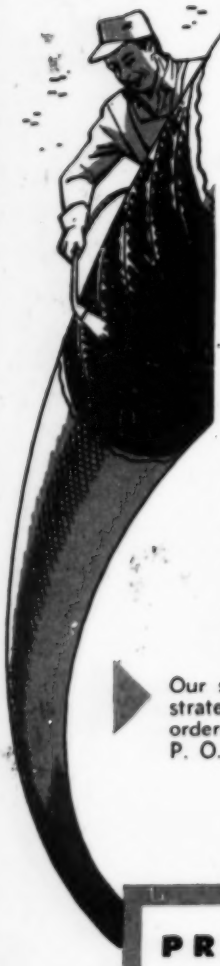
The gas phase pressure-volume-temperature data were determined by a study of the pressure-temperature relations at constant density of four mixtures of methane and ethane. (A description of the apparatus used is published for the first time in this bulletin.) Five to eight constant density lines (isometrics) were investigated for each mixture. The data, covering the range from the critical region to +90° F and pressures to 4000 psia, are presented in chart form as plots of the compressibility factor versus pressure, with lines of constant temperature. Compressibility factors calculated from the data are believed accurate to ±0.3%.

The experimental compressibility factors have been compared with data calculated by Kay's pseudo-critical rule used in conjunction with a generalized compressibility factor chart for methane. This comparison indicates that for natural gases containing less than 10% ethane, the error introduced by this method due to the presence of ethane will in general be less than 1%. The experimental data are also compared with values calculated using the Benedict-Webb-Rubin equation of state, with the constants for the mixtures obtained by combining the constants for methane and ethane. This comparison indicated a need for adjusting the method of combining the constants, and an empirical combination rule for the A_o term is proposed which brings the calculated data for all mixtures into excellent agreement with the experimental data. A comparison of the experimental pressure-volume-temperature data with the data of Sage and Lacey shows good agreement below 1000 psia, but rather poor agreement above 1000 psia.

YOU NEED

PROTECTO WRAP...

FOR THE FAST, EASY AND ECONOMICAL COATING OF FIELD JOINTS, GAS SERVICE FITTINGS AND MECHANICAL COUPLINGS



PROTECTO WRAP is a hot applied protective coating in roll form for field joints on mill or yardcoated pipe, fittings, couplings and other metal surfaces exposed to above and below ground corrosion.

PROTECTO WRAP consists of a plasticized coal tar or asphalt enamel, of the types used for pipeline coating, saturated into a glass fabric that acts as a carrier and reinforcement for the enamel. PROTECTO WRAP is interwoven with a paper separator that insures even distribution of the coating as well as easy unwinding, regardless of temperature. The material is used to coat mteal surfaces where the quality of hot applied reinforced bituminous coating is desired.

PROTECTO WRAP is available in 2, 4 and 6 inch widths, fifty feet in length; and in 18 and 24 inch widths, 30 feet in length.

Our sales representatives are available to demonstrate this material and method. Address your orders or inquiries to our nearest sales office or to P. O. Box 82, Englewood, Colorado.

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PROTECTO WRAP COMPANY
ENGLEWOOD, COLORADO

Regulators

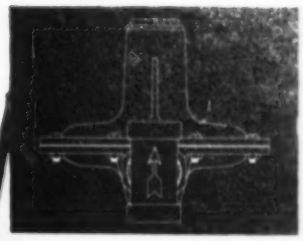
with Turn-About BODY

New design allows regulator to be installed in *ANY* position. Factory tested and assembled as you specify or can be easily changed in the field. No special wrenches required. All working parts still interchangeable. Suitable for all standard pressures and for low pressures on pressure elevation programs. Available in ¾", 1" and 1¼" Body Sizes.

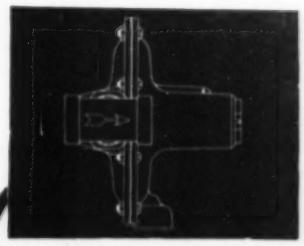
Write for new Catalog P10A.

FISHER GOVERNOR COMPANY

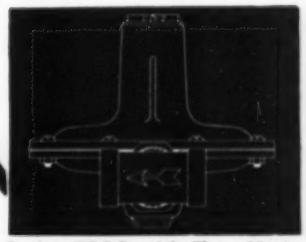
MARSHALLTOWN, IOWA



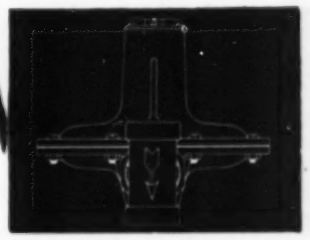
Series 730C For Standard Installation



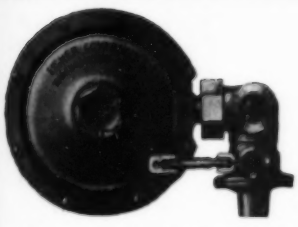
Series 730CDU For Outdoor Installation with Diaphragm Vertical and Weatherproof, Bugproof Drain Vent



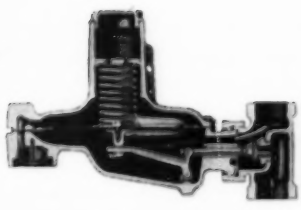
Series 730C with Flow Horizontal from Right to Left



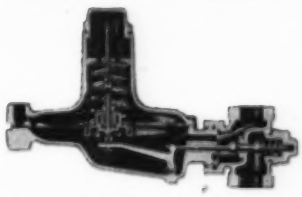
Series 730C with Flow Downward in Direction



• **Type 732CN General Service Regulator** with Full Capacity Relief Valve on Body. Sizes ¾", 1", 1¼". Spring bonnet vented to ¾" outlet of full capacity relief valve to allow use of single regulator vent line on indoor installations.



• **Type 730CU Outdoor Service Regulator.** Weatherproof vent housing integral with lower casing for outdoor locations.



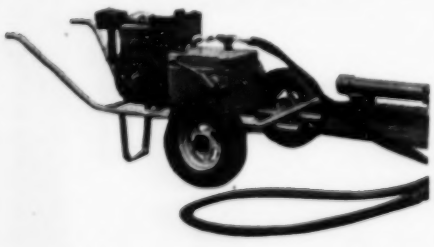
• **Type 735CT General Service Regulator** with Magnetic Safety Shut-off Feature. Shuts off the flow of gas entirely either if the downstream pressure should exceed the regulator setting by a predetermined amount, or if there is a failure or near-failure of supply pressure.

• **Type 733CT General Service Regulator** with Internal Relief Valve. Complete with weatherproof stabilizer vent for remote venting of indoor installations.

FISHER

"Pipe installation time and labor costs cut about 50% with Greenlee Pipe Pusher"

That's what a leading eastern utility reports as its experience with a GREENLEE Pipe Pusher on jobs as shown above. Let this remarkable tool make big timesavings and reduce job costs for you, too. With the GREENLEE Pusher, *one* man pushes pipe *under* streets, walks, floors, railways, lawns, etc. Eliminates extensive trenching and time-consuming tearing up, tunneling, backfilling, repaving. Often pays for itself on the first few jobs. Two models: No. 790 for pushing ¾" to 4" pipe; No. 795 for larger pipe and concrete ducts.



POWER PUMP for all models of GREENLEE Pipe Pushers. Makes the toughest pushing jobs simple, fast for *one man*. Average pushing performance: two feet per minute. Write today for complete details on timesaving GREENLEE Hydraulic Pipe Pushers.

GREENLEE

GREENLEE TOOL CO., Division of GREENLEE BROS. & CO.

1942 Columbia Ave., Rockford, Illinois

People

Promotions

HUDSON W. REED has resigned as a director and vice president of the United Gas Improvement Co. and as general manager of the Philadelphia Gas Works Div. THOMAS S. LEVER succeeds him as vice president of UGI and general manager of Philadelphia Gas. GEORGE R. BAILEY of Harrisburg, was elected a director.

W. W. Stake **A. O. Dragge**
A. O. Smith Corp.

Recent A. O. Smith Corp. appointments naming regional managers include: WALTER W. STAKE, formerly assistant general sales manager for Permaglas-Heating Div., New York, will head the eastern district; ALLEN O. DRAGGE, formerly in charge of West Coast operations, is now in charge of the Pacific Coast area; CHARLES E. HEITMAN, who was manager of the Automotive Div. of the corporation, has been named to fill the newly created post of assistant to the general manager.

Upon the retirement of two of its top executives, RAYMOND S. FULLER and FREDERICK F. DOYLE, Pacific Gas & Electric Co. has appointed PHILIP E. BECKMAN vice president in charge of gas operations and GEORGE H. HAGAR vice president in charge of electric operations. W. G. B. EULER, executive vice president and former vice president and general manager of the company, has also retired.

The three retiring men have had long careers in the gas industry. Mr. Doyle began his career in 1912 with United Gas Improvement Co. He also served with Midway Gas Co. and upon its merger with Southern California Gas Co., became supervising engineer in charge of all engineering. He joined PG & E to assist in the completion of its transmission system from the Buttonwillow and Kettleman Hills fields to the San Francisco Bay area. He then put into operation the company's natural gas division, and became its manager.

HUGH M. LITTLE has been named a vice president of Le Roi Co., Milwaukee. NORMAN J. KIMBER has been promoted to works manager of the company's Milwaukee Div. Mr. Little will be in charge of all co-

H. M. Little **N. J. Kimber**
Le Roi Co.

ordinating activities between Le Roi and Westinghouse Air Brake Co., its parent firm.

After 49 years of active service J. A. KEOGH, Allis-Chalmers Manufacturing Co., Milwaukee, has resigned as vice president and comptroller. He is succeeded as comptroller by T. D. LYONS, who has been assistant comptroller since 1951. WILLIAM J. KLEIN, manager of the Tractor Div., Minneapolis branch, has been named vice president and general sales manager.

The A. V. Smith Engineering Co., Ardmore, Pa., has appointed J. J. MEANY to a vice presidency in charge of corrosion studies made in the field.

Recent Rockwell Manufacturing Co. promotions include: JOSEPH POMMERSHEIM, a project engineer at the company's Homewood plant, to chief engineer of the Norwalk, Ohio plant; DR. CHARLES J. KENTLER JR., manager of refinery and chemical sales, to technical consultant for the entire Meter and Valve Div. A. G. RICKETTS, supervisor of the sales order department of the Nordstrom Valve Div., has been transferred to the company's Oakland, Calif. plant,

R. S. Fuller **F. F. Doyle**
Pacific Gas & Electric

P. E. Beckman **W. G. B. Euler**
Pacific Gas & Electric

ROPER gas ranges

IT'S NEW THROUGHOUT

NEW SPARKLING BEAUTY
NEW "STYLE-STREME" TOP
NEW BALANCED FRONT
NEW BRIGHT-FINISH "SPILL-AWAYS"
NEW "EMBASSY" DOORS
NEW "GLAMOR-GRILL"
NEW CONCEALED BURNER TRAYS

PLUS ALL THESE PROVEN FAVORITES

- Wide Selection of Cooking Tops
- Popular "Insta-Set" Control Panel
- "Spectro-Matic" Burner Control
- "Insta-Matic" Oven Guardian
- Precision "Melody" Timer
- "Roper-Glo" Broiler Burner
- Comfort-Level Broiler
- Famous "Bake-Master" Oven
- And Many Others

Built to "CP" Standards

Yours to sell at a profit!

J. Pommersheim
Rockwell Mfg. Co.

C. J. Kentler Jr.
Rockwell Mfg. Co.

H. O. Proske
Rockwell Mfg. Co.

C. O. Hollen
Ridge Tool Co.

where he will coordinate joint sales planning between the Pittsburgh and Oakland plants. W. C. LINDLEY is manager of budget planning and E. E. OLSEN manager of cost accounting. H. O. PROSKE, service manager for Meter and Valve Div., is national representative specializing in gas meter sales promotion.

R. W. Hamlin
Ridge Tool Co.

M. B. Williams
Ridge Tool Co.

As a result of the retirement of C. O. HOLLEN, Ridge Tool Co., Elyria, Ohio, has made the following appointments: RALPH W. HAMLIN takes over as sales representative in New Jersey, part of Pennsylvania, and Wilmington, Del. M. B. WILLIAMS will cover the District of Columbia, Maryland, part of Delaware, Virginia and North Carolina.

Robertshaw-Fulton Controls Co. has appointed FRANK H. POST sales manager in charge of sales for the Robertshaw-Fulton Thermostat Div. and the American Thermometer Div., and E. J. HORTON will assume new duties in the company's executive office, Greensburg, Pa.

THOMAS L. VANCE has been promoted to sales representative for southern California, Nevada and Arizona by Dresser Manufacturing Div., Bradford, Pa. He will headquarter in Los Angeles.

T. L. Vance
Dresser Mfg.

E. P. Additon
Blaw-Knox Co.

Blaw-Knox Co., Pittsburgh, has appointed E. P. ADDITON sales engineer for the Mid-Atlantic district of the Chemical Plants Div.

FRED L. PARKER has been appointed southern district sales representative of the Detroit Brass & Malleable Co. He will headquarter in Nashville, Tenn.

WILLIAM B. TIPPY, a vice president since 1947, has been elected executive vice president of Commonwealth Services Inc., New York.

American Car & Foundry Co., New York, has promoted RICHARD P. CONNETTE, assistant to the president, to the post of assistant vice president and has appointed WALTER L. HAMILL as sales representative in the northeastern territory comprising New Eng-

THE NEW M·S·A FIRST AID KIT IS DIFFERENT... BECAUSE OF IMPORTANT LITTLE THINGS LIKE THIS

Open lid serves as shelf when kit is mounted on wall or vehicle
Clear, concise, first aid instructions
Easy-to-keep-clean case
Wall mounting brackets
Dust and moisture proof rubber gasket
Packages extend above case for easy removal
Easy-to-read identifications

Here's a First Aid Kit that gives you the important *extras* in quality and performance. A few of the important case design and construction features which serve your needs better are illustrated above. And that's only part of the New M.S.A. First Aid Kit story. Quality control, and improved first aid materials are other important improvements that add up to the big difference!

So you can be sure of freshness, purity and sterility, every Unit "D" package is stamped with a Quality Control number. This number identifies the "pedigree" clear back through our every operation.

Our modernization program extends to first aid materials. Color keying of labels for antiseptics, burn treatments, and others assure quick identification. Swabs have gauze tips which are less absorbent, assure maximum utilization of antiseptic.

And there's more, lots more. Get the facts today. Write for our bulletin.

MSA
SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Avenue, Pittsburgh 8, Pa.

At Your Service: 82 Branch Offices in the United States and Canada

Manufactured under Consolidated Edison Co. of N. Y., Inc. Patent No. 2,342,045. Application development assistance by Public Service Electric and Gas Company of New Jersey

J. P. GLASBY MFG. CO., Inc.

Belleville 9, N. J.

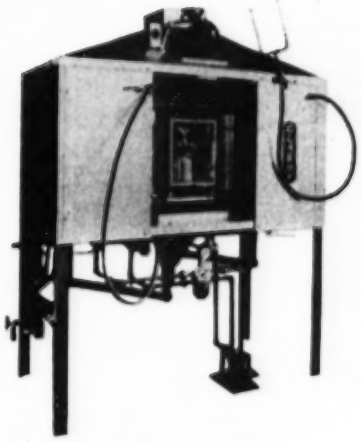
Manufacturers of Glasby Conversion Burners and Furnaces

PRECISION REPAIRS ON MACHINES CUT TIME AND EFFECT SAVINGS!

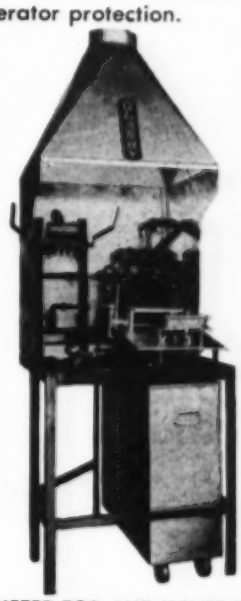
Leading utilities now rely on

GLASBY METER REPAIR MACHINES

and reduce repair time to a minimum. Front and Back Machine and Top and Valve Box Machine both available in 5 and 10 light meter capacity and adjustable to most makes of meters. They feature approved safety devices for operator protection.



METER FRONT AND BACK REMOVING MACHINE



METER TOP AND VALVE BOX REMOVING MACHINE

MAXITROL

scores another first!

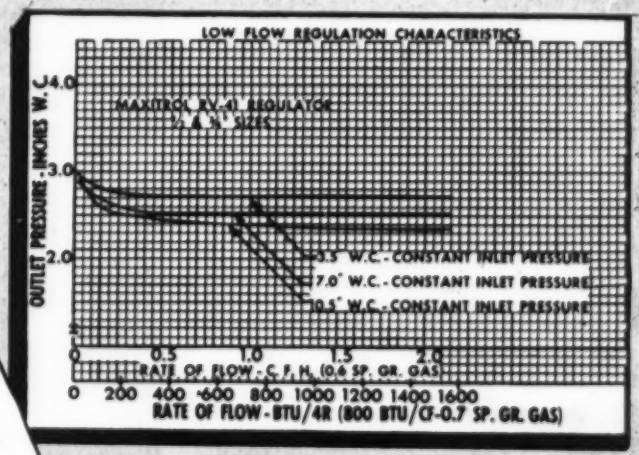
a new, modern GAS APPLIANCE REGULATOR specifically designed for: RANGES . . . FLOOR FURNACES . . . WALL HEATERS . . . CIRCULATORS . . . INDUSTRIAL EQUIPMENT PILOT REGULATOR

FOR THE FIRST TIME: MAXITROL Company has developed a modern gas appliance pressure regulator in the new RV-41 which features a non-metallic seating surface. The first of its kind on the market the RV-41 will fast prove the superiority found in all MAXITROL products.

ADVANTAGES:

1. Non-Metallic Seat permits accurate regulation at ¼ cu. ft. per hour, insuring regulation even at minimum pilot flows.
2. Small Breather Hole eliminates need for supplementary vent leak limiting devices.
3. Low Cost. 4. A.G.A. Certified.
5. Spring adjustable outlet pressure.

Tomorrow, as yesterday, you may look to MAXITROL for engineering and product leadership.



SPECIFICATIONS

Model	Pipe Size	Capacity CFH 0.6 SP. GR. Gas	Capacity Btu/HR 0.6 SP. GR. Gas	Capacity Btu/HR 0.7 SP. GR. Gas
RV-41	½ in.	100	50,000	74,000
RV-41	¾ in.	130	65,000	96,000

MAXITROL COMPANY

12200 BEACH ROAD
DETROIT 28, MICHIGAN

Sold on the Pacific Coast by:
PACIFIC SCIENTIFIC CO.
San Francisco, Los Angeles, Seattle, Portland

R. P. Connette
American Car

C. Hall
Bowser

land, New York, and New Jersey. JAMES F. CLARK, vice president of finance, is a newly elected member of the board.

Transfers

CLIFFORD E. HALL, former promotion manager of the AGA, is now sales manager for the Incineration Div., Bowser Inc., Cairo, Ill.

PAUL E. QUINN, formerly associated with the Indiana Gas & Water Co., has been named manager of the Elizabeth & Suburban Gas Co., Elizabeth City, N. C., a subsidiary of Pennsylvania & Southern Gas Co., Westfield, N. J.

W. L. KELL has joined the International Sales Co., San Francisco, as sales manager, in which position he will handle sales with JIM DEANE, who with CHARLES E. LARSON, was recently made a vice president of the company.

LOVETT C. PETERS has resigned as financial vice president of Laclede Gas Co., St. Louis, to become financial vice president of the Continental Oil Co. in Houston.

EVERETT L. DAWKINS has joined the Williams Div. of Eureka Williams Co. as sales representative in Massachusetts.

A. D. MacLean
Mueller Co.

E. L. Dawkins
Eureka Williams

ALLEN D. MAC LEAN, well-known industry engineer and the author of many articles appearing in past issues of GAS, has been named chief products engineer for the Mueller Co., Decatur, Ill. Mr. MacLean's background includes association with Pittsburgh Equitable Meter Co. (Rockwell Manufacturing Co.), H. K. Porter Co., and Chaplin-Fulton Manufacturing Co., with which company he retains a consulting position. In addition he has served as director of production for the U. S. Maritime Commission.

Deaths

Elliott Taylor

ELLIOTT TAYLOR, nationally known gas industry publisher and editor, and former editorial director of GAS magazine, died suddenly at his home in Gettysburg, Pa., on Christmas Day. He was 55.

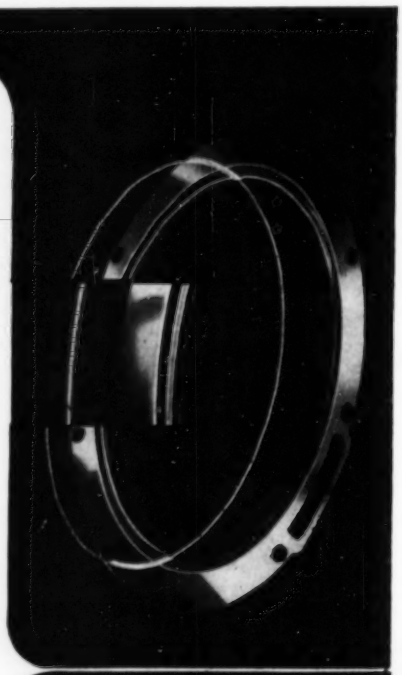
Mr. Taylor had been a vigorous and colorful writer on gas and L.P. gas industry matters for more than 25 years, dating back to his first association with Jenkins Publications Inc., publisher of BUTANE-PROPANE News and GAS magazine. Since 1949, Mr. Taylor had been editor and publisher of *American Gas Journal*.

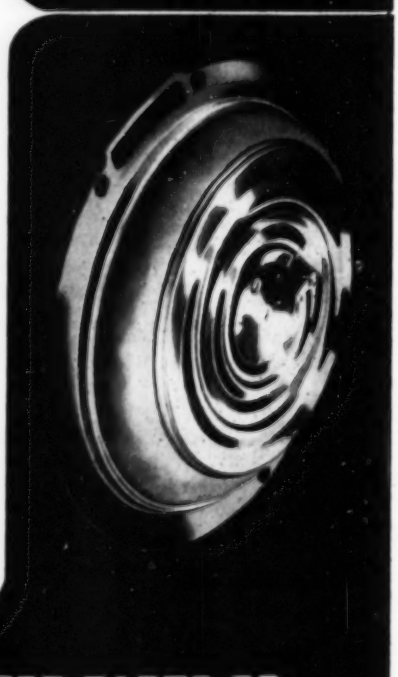
In 1938, Mr. Taylor collaborated with his wife, Katherine Kressman Taylor, in the formulation of a highly successful book entitled "Address Unknown," a dramatic story written in the form of letters exchanged between a San Francisco importer and a colleague in Nazi Germany.

See How This Groove Gives You

SMOOTHER METER PERFORMANCE

There are important advantages in this new Lancaster S-7 Groove Type *Metal Rim Diaphragm. The groove increases strength and assures perfect centering and balance. The endless metal ring provides a stronger wrap with uniform pressure. At both "in" and "out" stroke extremes there's an equal amount of leather, with no unnecessary surplus, especially on the "in" stroke, to cause displacement inconsistency. No wonder more and more meter shop men are now specifying this improved design Lancaster S-7 Groove Type Metal Rim Diaphragm. *Send for prices and literature today.*





New Groove Type Metal Rim for greater rigidity and a perfect circle.

New Patented Endless Metal Tie Band for stronger clamping, more uniform depth of pocket.

New Improved Quality Rechrome Leather specially processed to Lancaster's own specifications.

*PATENT PENDING

METER PARTS CO.

ARTHUR F. BENSON, 58-year-old vice president of the American Meter Co., died recently. He had been with American Meter since 1930, when he joined the Metric Metal Works in engineering and sales work. He also served as chief engineer from 1943 until 1947, when he was appointed chief engineer and vice president-production and research. In 1950 he was elected vice president-engineering.

A. F. Benson
American Meter

L. L. Tonkin
Hope Natural

LORING L. TONKIN, former president of the Hope Natural Gas Co., died late in 1953 at the age of 66. Joining Hope in 1903, Mr. Tonkin served successively as assistant supervisor of compressor stations, assistant general superintendent, and a vice president before he was elected president and general manager in 1939. In 1951, he was named chairman of the board. He retired in 1952.

J. A. WHITTINGTON, utilization testing engineer of the research testing department of Peoples Gas Light & Coke Co., Chicago, died recently of a heart attack. He retired from Peoples in 1948.

HERMAN E. PHILIPP, senior gas engineer of the New York Public Service Commission, died recently. Mr. Philipp, 47, had been with the commission for 17 years.

ALBERT G. LINDSAY, manager of Rockwell Manufacturing Co.'s export and international divisions, died recently after a four-month illness.

LESLIE A. BURD, 47, formerly of the Oklahoma Natural Gas Co. and an auditor for the FPC, died late in December.

OTIS W. TWITCHELL, 83, a retired chief special agent for the Southern California Gas Co., Los Angeles, died recently. Mr. Twitchell had been with SoCal from 1907 until 1935, when he retired.

ALBERT L. TOSSELL, former vice president and secretary of the Peoples Gas Light & Coke Co., Chicago, died late in December at the age of 73. He retired from Peoples Gas in 1946.

MAURICE A. DONOVAN, personnel manager of the Columbia Gas System, died in Jersey City recently after a short illness. He was 55.

maintains fast "work-and-run" schedules

CHECK THESE ADVANTAGES:

- ☐ **12.6 mph mobility on rubber**
- ☐ **automotive steering**
- ☐ **truck-type hydraulic brakes**
- ☐ **digs up to 14½ ft. per min.**
- ☐ **8 to 16 in. wide, 5 ft. deep**
- ☐ **positive down-crowd boom**
- ☐ **high-carbon cast-steel buckets**
- ☐ **easy-insert "Tap-In" teeth**
- ☐ **shiftable, reversible conveyor**
- ☐ **43.6 h.p. gas engine**
- ☐ **6-ft. backfill blade (optional)**

Parsons rubber-tired 88 Trenchmobile is the low-cost answer on widely-scattered, small-yardage trenching jobs, where it costs more to move big equipment in and out than it does to move the dirt. This mobile trencher drives cross-town at 12.6 m.p.h. . . . digs house-to-street service connections at speeds up to 14½ feet per minute... drives on to next job without delay.

With its 8 to 16-inch cutting widths, and maximum depths of 5 feet, Trenchmobile is also big enough for main line excavations. It saves a lot of costly hand clean-up, too . . . undercuts sidewalks, curbs, gutters, mains . . . makes vertical set-ins flush with foundations . . . backfills its own trench (blade optional). Get the complete story from your Parsons distributor, or write us.

Want more facts? Write PARSONS CO., Newton, Iowa for bulletin on 43.6 HP 88 Trenchmobile

NAME _____
TITLE _____
COMPANY _____
DIVISION _____
STREET _____
CITY, STATE _____

P466 GAS

PARSONS Trenchmobile
(Koehring Subsidiary)

ASSOCIATIONS

Home service workshop held in Columbus

The AGA Home Service Workshop was held in Columbus, Ohio, Jan. 18-20 with headquarters at the Deshler Hilton hotel. Chairman Mary E. Huck, Ohio Fuel Gas Co., reports that home service representatives, sales managers and others in the gas industry who are interested in home service operation and its relation to sales attended the workshop, which had as its theme "How to Do It and Why."

Equipment and ways to put it over, and "Sales Profiles for Home Service" from a sales manager's viewpoint were discussed.

Symposium on methods for testing L.P. gases

A symposium to be jointly sponsored by ASTM Committee D-2 on Petroleum Products, ASTM Committee D-3 on Gaseous Fuels, California Natural Gasoline Assn. and the Natural Gasoline Assn. of America on methods for testing liquefied petroleum gases will be held Sept. 27-28 at the Statler hotel, St. Louis, Mo. A number of other trade associations and regulatory bodies have been invited to assist.

The program will consist of papers on all phases of LPG testing with contributions from many interested groups within the industry. Contributions from consumer groups and papers on field tests are particularly solicited.

There will be a place on the program for any paper describing a test method, however simple, if the test yields significant information

Curtis Morris named to AGA Washington office

George Smith

Curtis Morris, transmission line consultant, American Gas Assn., and former vice president, Transcontinental Gas Pipe Line Corp., has been appointed Washington representative of AGA. He will take charge of the new association office at room 804, Securities Building, 729 - 15th St., N.W., Washington, D. C., where he will give full time service to member companies of the association.

Mr. Morris succeeds George H. Smith, who retired on Dec. 31 as assistant managing director of AGA, an office he held since he joined the association in 1944.

With Transcontinental Gas, Mr. Morris engaged in legislative, tax and public relations matters for the corporation. Before joining Transcontinental he represented Texas public and private agencies in Washington in the Tidelands case. His wide knowledge of the natural gas industry and his broad acquaintance in Washington will be of great value to AGA members.

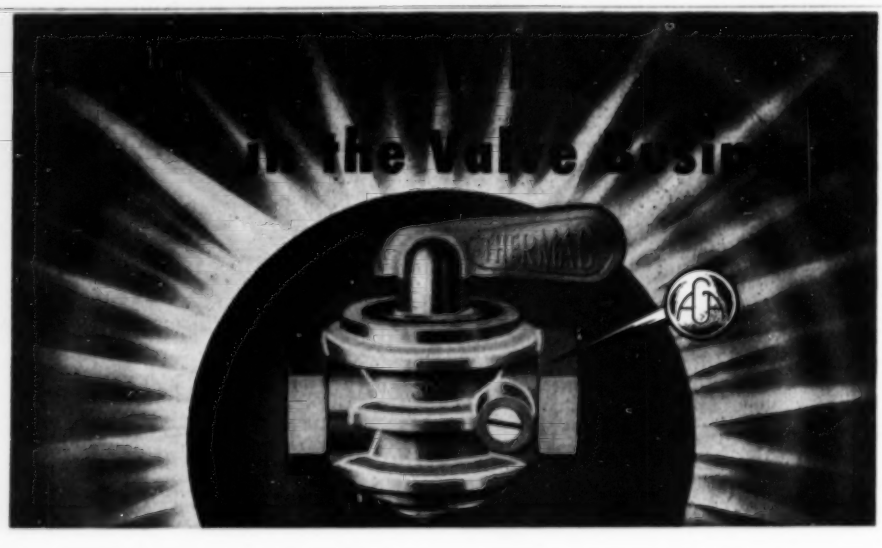
NACE elects national, regional officers

Kempton H. Roll, Lead Industries Assn., New York City, has been elected chairman of northeast region, NACE. Also elected to serve during 1954 were Edward G. Brink, American Viscose Corp., Marcus Hook, Pa., vice chairman, and Edwin J. Titsworth, Koppers Co. Inc., Boston, secretary-treasurer.

Elected to a three-year term on the NACE board of directors, George E. Best, Mutual Chemical Co. of America, Baltimore, succeeds L. B. Donovan, Consolidated Edison Co., New York City.

Pipeline discussions at Kansas City

All persons interested in mutual discussions of pipeline corrosion problems are invited to participate in the pipeline group



LARGE CAPACITY... PERMITS SMALLER, LESS EXPENSIVE CONTROLS

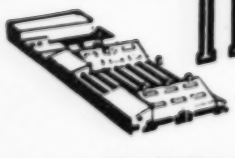
THERMAC ALUMINUM ALLOY GAS SHUT-OFF VALVE

1. GREATER STRENGTH AND RIGIDITY
2. HIGH STRENGTH, HEAT TREATED ALUMINUM ALLOY
3. EXTRA CAPACITY LOW PRESSURE DROP
4. NON-CORROSIVE
5. LOW COST
6. AGA CERTIFIED

A new idea in valves—the most revolutionary improvement in gas equipment in 40 years. So outstanding is this free-flow, low pressure drop shut-off valve, that appliance manufacturers are recalculating and redesigning their manifolds using smaller regulators and controls with savings up to $10.00 per unit.

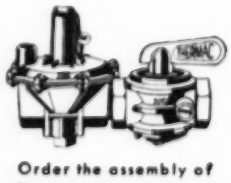
Here's the secret: the valve plug is much larger than usual so that the gas passageway is not "pinched" down. Get a sample and check it for yourself.

In strength, this specially heat-treated, aluminum alloy valve exceeds anything yet built. The valve rotor is treated with a long-life lubricant. It's AGA certified and built by Thermac, an age-old name in gas controls. Send for sample and bulletin today. Available in ½" and ¾" pipe sizes.



THERMAC COMPANY

800 EAST 108TH STREET • LOS ANGELES 59, CALIFORNIA



Order the assembly of Thermac regulator and shut-off valve to your own specifications.

discussions to be held during the 1954 annual meeting of the National Assn. of Corrosion Engineers. They will be held at Kansas City, March 15-19, during the association's tenth annual conference and exhibition.

Each of the eight discussion groups will consist of not more than 40 persons. The meetings are open to members and nonmembers of NACE alike. An experienced corrosion engineer will act as moderator of each group, and in addition, an added panel of some of the nation's best known experts on underground corrosion will be available for consultation when necessary. There is no limit to the number or type of questions asked.

Ray Little to direct GAMA sales promotion

Ray Little

Ray Little, for the past nine years general sales manager of the Equitable Gas Co., Pittsburgh, has joined the Gas Appliance Manufacturers Assn. as director of sales promotion.

In this new GAMA post, he will direct the promotional activities of all of the product divisions of the association, and will coordinate tie-ins for the appliance manufacturers with the $1.25 million advertising and promotion program of the American Gas Assn. His activities will concern all members of the family of gas appliances and equipment.

Mr. Little is presently serving as chairman of the AGA residential section.

Rocky Mountain Gas Assn. elects officers

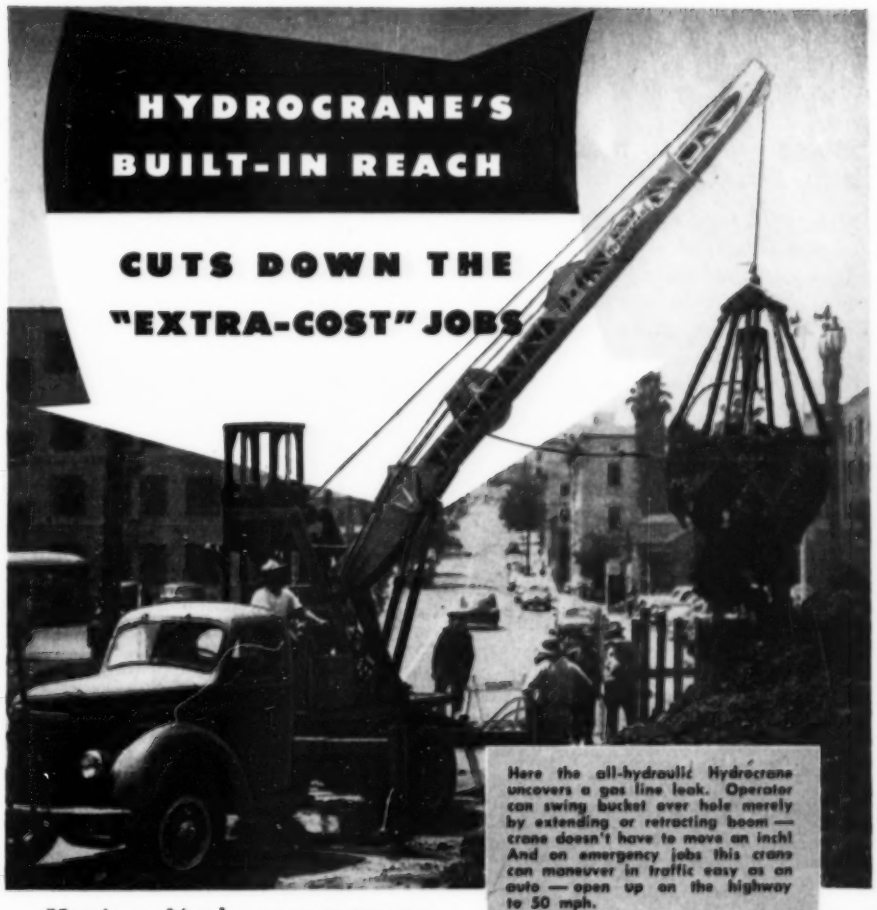
Roy Munroe

The Rocky Mountain Gas Assn. elected the following officers for 1954 at its annual meeting, which was held in Denver:

Roy G. Munroe, Public Service Co. of Colorado, president; William Van Genderen, Van Genderen Heating Co., vice president; L. D. Warner, The Warner Co. Inc., vice president; S. J. Neely, North Denver Furniture Co., secretary-treasurer.

Directors include: G. Meredith Musick; F. V. Wedlick, Killam Gas Burner Co.; Frank L. Welle, Good Plumbing Co.

It was announced at the meeting that it is planned that pressure and temperature relief valves will no longer be required on auto-



Here the all-hydraulic Hydrocrane uncovers a gas line leak. Operator can swing bucket over hole merely by extending or retracting boom — crane doesn't have to move an inch! And on emergency jobs this crane can maneuver in traffic easy as an auto — open up on the highway to 50 mph.

Here's a ⅜-yd. crane-excavator that can prove the handiest of cost cutters for you because it reaches for those extra jobs other machines can't handle. It digs and lifts hydraulically, travels from job to job at normal truck speeds — up to 50 mph on the open road — and has a hydraulically telescoping boom that means substantial savings on jobs like these:

1. **On gas pipe laying and valve settings,** the Hydrocrane reaches under branches and low overpasses, between buildings, into narrow alleyways — eases loads into place quickly, safely, easily.

2. **On leak repair work,** the Hydrocrane digs trenches, uncovers pipe leaks, handles many other digging jobs — often *by reaching out* while the crane itself stays out of the way of traffic.

3. **On yard work,** reaches into windows and box cars . . . over fences . . . between stockpiles to move material, loads and unloads trucks — in a hurry.

Quick Convertibility to Hydrohoe

By actual time test, crane has been converted to dragshovel front end by one man in *less than one hour!* And on trenching, telescoping action of Hydrohoe boom cuts lost time moving up by as much as 40 percent.

Get the full story on the all-hydraulic Hydrocrane. Send coupon today.

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BUCYRUS-ERIE COMPANY
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Gentlemen:
Please send me literature on the Hydrocrane and Hydrohoe.

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29H53

matic gas water heater installations in the city and county of Denver. It was expected that this ordinance would be enacted promptly.

Eastern group formed within GAMA

Formation of an eastern manufacturers group within the GAMA's water heater division has been announced by the trade group. Eleven manufacturers' representatives attended the first meeting of the group recently held in Cleveland.

Harry B. Carbon, Bastian-Morley Co. Inc., was elected chairman and Lee W. Rasch, Rasch Manufacturing Corp., was named vice chairman.

The group was formed of GAMA water heater manufacturers who are not members of the Pacific Coast Gas Assn., which has long had its own water heater organization. It will discuss primarily problems of interest to eastern manufacturers and will act in the east as does its counterpart in the west.

Two new sections make NACE total 38

Formation of two new sections in the northeast region, National Assn. of Corrosion Engineers, brings to 10 the number in the region and to 38 the number in the United States and Canada. The sections are: the Gennessee valley and the Schnectady-Albany-Troy section. A third section to be called the Rocky Mountain section is being organized in the NACE south central region.

Taking the lead in organizing the Gennessee valley section was Orson J. Britton, The Pfaudler Co., Rochester, N. Y., and for the Schnectady-Albany-Troy section it was Arthur C. Mengel, American Locomotive Co., Schnectady, N. Y.

W. H. Adams retires as AGA safety consultant

W. H. Adams

The American Gas Assn. announced that W. H. Adams, safety consultant at AGA since 1951, retired on Dec. 31. A veteran of more than 50 years service in the gas industry, he joined the association after serving as safety director of The Manufacturers Light & Heat Co., Pittsburgh. His previous service covered nearly every phase of gas industry operations.

Mr. Adams is a past chairman of the AGA accident prevention committee; past chairman of the public utilities section, National Safety Council; a member of the American Society of Safety Engineers and Veterans of Safety.

He will devote part of his time in the future to safety consultation work for public utility companies.

Association notes

The following five new members have joined GAMA: Control Engineering Corp., Norwood, Mass., which will manufacture a combination automatic pilot and gas control valve; United States Stove Co., South Pittsburg, Tenn., makers of vented and unvented domestic room heaters and unvented wall heaters; General Manufacturing & Distributing Co., Quincy, Mich., which is developing a gas water heater; Waterfilm Boilers Inc., Jersey City, manufacturers of gas-fired boilers; and Pittsburgh Water Heater Co., San Francisco, which plans to make a gas water heater.

Industry and management problems regarding the health and safety of industrial workers will be thoroughly discussed at the 1954 Industrial Health Conference, which will be held at the Hotel Sherman, Chicago, April 26-30. Over 2000 leaders in industrial health from throughout the United States and Canada are scheduled to be present at the five-day meeting. Theme of the conference will be "Protecting our greatest industrial wealth—employees' health."

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MECHANICAL JOINT CAST IRON PIPE

Practical water or gas distribution men well know that pipe line settlement, expansion and contraction from season to season sometimes cause joint leaks in bell-and-spigot pipe lines.

This kind of trouble may be prevented in future pipe line construction by the use of McWane-Pacific Boltite mechanical joint cast iron pipe. Boltite mechanical joints stay flexible; permit settlement, expansion or contraction without leakage. The special bolts, glands, and sealed-in rubber compound gasket last as long as the pipe.

For details, wire or write McWANE CAST IRON PIPE COMPANY, Birmingham, Alabama, or PACIFIC STATES CAST IRON PIPE COMPANY, Provo, Utah. (Sales offices in principal cities.)

McWANE PACIFIC PIPE Lasts for Centuries

NEWS

Four Texas companies merge into Pioneer Natural

West Texas Gas Co., Amarillo Gas Co., Dalhart Gas Co., and Clayton Gas Co. have been consolidated into one natural gas utility operating company, the Pioneer Natural Gas Co. SEC approval of the simplification of the corporate structure of the companies has been received.

Pioneer Natural will serve some 60 cities and towns through an area reaching from Clayton, N. M., on the north to Midland and Odessa, Texas, on the south. Officers of the company are George Baird, president; M. D. Snyder, vice president and secretary; Thomas F. Cartwright, vice president and treasurer; H. R. Budke, C. I. Wall, and A. F. Cox, vice presidents.

Pioneer has one wholly owned subsidiary, Amarillo Oil Co., which has acquired the assets and business and assumed the liabilities of Red River Gas Co. It is primarily a producing company but also handles field gathering, field compression, and extraction and sale of liquid petroleum products.

Lubbock is headquarters for Pioneer's west Texas division, which comprises the area formerly served by West Texas Gas. The company's general offices are in Amarillo.

A meeting of stockholders of Southwestern Development Co., which owns Pioneer, is scheduled for this month to vote on the liquidation and dissolution of Southwestern.

Spotlight on water heaters, dryers early in '54

The first 1954 advertising-promotion campaigns to be sponsored by the AGA in February and March will feature automatic gas water heaters and clothes dryers. In addition to national magazine advertising, the campaigns will use point-of-sale displays, demonstrations, direct mail, and newspaper, radio, television, and billboard advertising.

Campaign objectives will be to upgrade quality and size of water heaters in the replacement and new-home markets, and to sell men on buying gas dryers for their wives. Two promotion display kits are available for the campaign.

Panellit makes first move toward consolidation

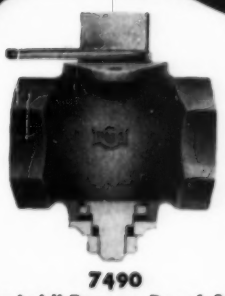
Panellit Inc. has started construction of a million dollar plant in Skokie, Ill., which will house all engineering, manufacturing, and administrative activities now spread out in seven locations in Chicago.

The building, the first step in a major expansion and consolidation program, is a one-story, 82,000-sq ft project. Plans provide for ultimate expansion to 150,000 sq ft.

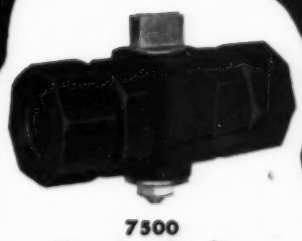
Included in the consolidation of Panellit's

IT PAYS TO BUY HAYS that are TOPS

7405
Iron Body, Galvanized, Bronze Plug Stop



7490
"Key-Lok" Tamper Proof Stop Lockwing—Iron Body, Bronze Plug



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Threadless Gas Stop Iron Body, Brass Plug

Service Line Stops—Meter Stops
Appliance Stops

Tamper Proof and Standard Patterns

Iron Body with Brass Plug
Black or Galvanized
Also All Brass Stops

Flat Head—Flat Head with Lockwing

Full Range of Sizes

Quality Assured . . .
By Precision Machining—
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Quality Proven . . .
By Supplying the Gas Industry for Over 80 Years

Standard Packaging for Easy Handling, Space Saving Storage . . . Another HAYS First

Write for literature, or ask "The Man from Hays"

GAS SERVICE PRODUCTS
HAYS MANUFACTURING CO.
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NO "CRYSTAL BALL" NEEDED

Detectron "505"
PIPE DETECTOR
takes all guesswork out of Pipe Detection

◀ DETECTS, TRACES and CENTERS PIPE, CABLE, ETC.
◀ ESTIMATES EXACT DEPTH
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A crystal ball might be one way to locate buried pipe or cable at an excavation site. But . . . a *better, safer* and *more efficient* way is to use the new, improved Detectron "505" that accurately pinpoints the exact length, depth and location. *Stop guessing —and be sure!*

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Trenches Any Depth to 36"

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activities in Skokie will be two subsidiaries, Panalarm Products Inc., manufacturer of industrial alarm systems and panelboard accessories, and Panascan Inc., manufacturer of large-scale multiple systems.

Montana-Dakota sells gas property to Montana Power

The natural gas properties of Montana-Dakota Utilities Co. in the Great Falls-Havre, Mont., area have been sold to Montana Power Co., Butte, for an estimated $6.5 million. Properties involved include the Kevin-Sunburst, Cut Bank, and neighboring gas fields together with transmission and distribution facilities serving a number of northern Montana communities.

A wholesale gas sales contract with Great Falls Gas Co., together with production and transmission facilities serving the Great Falls market, is also included in the deal. The transactions relieve Montana-Dakota of properties not connected with the rest of its system.

The two companies have entered into a contract that will involve the sale of about 5 MMcf of natural gas annually by Montana-Dakota to Montana Power from recently acquired reserves in the Big Horn basin in northern Wyoming.

New company to operate Public Service properties

Another step toward putting Northern Illinois Gas Co. into business (see *GAS*, December, page 88, and January, page 87) was taken recently when a petition was filed with the Illinois Commerce Commission requesting authority for the new company to own and operate the gas properties of the Public Service Co. division of Commonwealth Edison Co. Hearing on the petition was expected to be routine since no changes in rates or service are involved.

Officers of the new company, which will be an Edison subsidiary, are Willis Gale, chairman and chief executive officer; Charles Y. Freeman, chairman of the executive committee; H. P. Sedwick, president. Edgar E. Lungren, executive vice president, will be in direct charge of the new company's operation.

Northern Illinois Gas, which will be the second largest gas utility in Illinois, will serve gas to about 450,000 customers in 232 northern Illinois communities outside Chicago.

Rockwell sponsors contest on planned meter retirement

A nation-wide contest on the general subject of planned meter retirement programs in the gas industry is being sponsored by Rockwell Manufacturing Co., Pittsburgh, for persons employed in the gas industry.

More than $5000 in prizes, consisting of

Delta power tools, will be awarded to winners in two categories. The first category is an essay on the subject "The Economics of a Planned Meter Retirement Program" and the second consists of filling in the last line of a jingle.

Traveling display kits show Burkay water heaters

In the interest of furthering the sale of Burkay commercial water heaters, the Permaglas division of the A. O. Smith Corp. is making available traveling window display kits, easily packaged for shipment and readily assembled.

Believed to be the first promotion of its type in this specific field, the units are supplied to distributors and utilities. It was designed originally as a tie-in with AGA's commercial water heating program, "Plenty of Hot Water Pays in Many Ways," which will be pushed nationally from February through April.

Part of the display is a cutaway heater showing its internal construction. Erected, the displays stand 6½ ft high by 6 ft wide. Several of the portable window displays are designed specifically with the restaurant field in mind; some of them are of general application, and others are beamed at industrial uses.

A. O. Smith's traveling water heater display showing internal construction through cutaway.

Rhode Island governor seeks utility regulation

More stringent regulation of public utilities, with the utilities themselves required to pay 45% of the costs of such regulation, was recommended by Rhode Island Governor Roberts in his annual message to the state legislature last month.

"The plant investment of the utilities which furnish our homes and our industries with electric, gas, water, telephone, and transportation services amounts to approximately $300 million," he said, "and the annual revenues received by these respective

THE NORMAC
BELL JOINT CLAMP

A SIMPLE SOLUTION for one of the GAS INDUSTRY'S *most trying problems*

Solves Your Joint Repair Problems • Quick • Easy • Permanent

Installed in small pavement openings. Available in all standard sizes from 3" to 12". A simple set of tools cleans the joint, installs the clamp . . . often in only a quarter of an hour. SAVES TIME. SAVES MONEY and the repair is permanent. Designed for all conditions particularly where pavement repair costs are prohibitive. Such small opening repairs are scarcely noticeable when pavement is replaced.

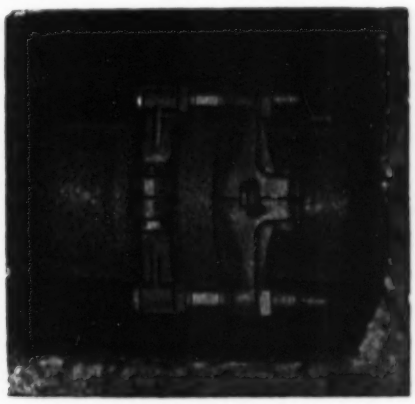
Normac Clamps can be installed in large as well as small openings.

Norton-McMurray hold definite leadership in the development of methods for installation and rehabilitation work through small openings. We welcome the opportunity to help solve a problem you may have—tell us about it.

Write for our catalog describing our complete line of

COUPLINGS . . . FITTINGS . . . SERVICE TEES and ELLS . . . SLEEVES . . . COMPRESSION-END COCKS . . . METER BARS and BRASS FITTINGS for copper pipe.

6 inch Normac Clamp being lowered into hole for installation



6 inch Normac Clamp in service after installation

NORTON-McMURRAY MFG. CO.

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Method and product covered by U. S. Patents, Nos. 2,163,261 and 2,178,286.

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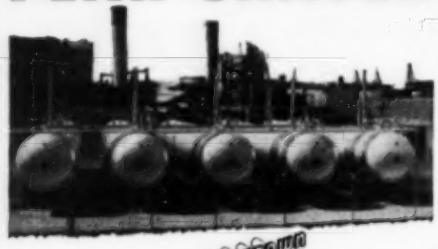

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utilities in the form of rates from . . . residents . . . and industries exceeds $75 million annually . . . When we consider these factors . . . there can be no disagreement as to the need for a strong, skillful, and fully staffed public utility administration."

The governor went on to advocate the hiring of additional engineers and accountants for specialization in the respective fields of utility regulation, and legal counsel on a full-time basis for the study and procedure of public utility law.

Despite defeat in 1953 of proposals regarding the regulation of utilities, Governor Roberts is determined to see that the public utility administrator is provided adequate facilities for the "determination he is called upon to make with respect to either the rates or services of our public utilities."

CEC Instruments moves into expanded quarters

CEC Instruments Inc., sales and service subsidiary of Consolidated Engineering Corp., Pasadena, Calif., has opened new and enlarged quarters in Pasadena for its western regional office.

Occupying approximately 2000 sq ft, the new office will have an 11-person sales and service staff to serve Consolidated users in the nine western states and in the Canadian provinces of Alberta, Saskatchewan, and British Columbia.

Gas commission considered by Ontario government

A natural gas commission, with powers similar to those of the Ontario Hydro Commission, is being considered by the provincial government of Ontario. Whether the commission would have its own chairman or the two commissions operate under one chairman has not yet been decided, but an eight-man committee composed of four cabinet ministers and three of Ontario Hydro's top officials is studying this and other aspects of the proposed commission.

It is believed that the committee will recommend establishment of a commission that will undertake transmission of natural gas on a wholesale basis and will build pipelines to serve Ontario communities where gas is not now available. Private companies now in operation will buy their gas from the commission.

The first stage of the planning committee's work, a survey of the potential large industrial markets in Ontario, has just been completed.

Rockwell Manufacturing expands two plants

Rockwell Manufacturing Co., Pittsburgh, has added footage to its gas meter plant in DuBois, Pa., and to its Norwalk, Ohio, plant.

The 19,000-sq-ft addition at DuBois con-

sists of a one-story, brick-and-tile structure, which will house manufacturing facilities for the company's large-capacity industrial meters. In mid-September, an 11,000-sq ft building was constructed in nearby Sykesville, providing additional gas meter manufacturing and storage space.

L. A. Dixon Jr., vice president of the meter and valve division, reports that production of large-capacity gas meters is being transferred from Pittsburgh to DuBois in order to consolidate meter production in one location.

The 25,000-sq ft addition at the Norwalk plant is being built to house production facilities of Rockwell's smaller balanced valve regulators. The one-story, brick-and-steel building is expected to be completed early this month.

The sale of manufacturing assets of Eureka Williams Corp., Bloomington, Ill., to Henney Motor Co., Freeport, Ill., was completed recently. Seated (l to r) are C. Russell Feldmann, president of Henney, and H. W. Burritt, president of Eureka Williams. Standing is B. C. Miller Jr., new executive assistant in charge of Eureka Williams. Mr. Burritt will continue with the new management on a consulting basis.

Ex-supervisor's charges disproved in Texas battle

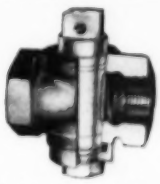
Charges leveled against the Fort Worth City Council, City Manager W. O. Jones, and Lone Star Gas Co. by a deposed gas supervisor, Mortimer Jones, were disproved recently by a 31-page report from Public Works Director Thelin. The ex-supervisor charged that Lone Star does not maintain adequate pressure in its lines, although he failed to present any technical data supporting his charges.

Highlights of Director Thelin's report are that the state legislature has established a standard pressure of 4 oz.; the AGA has established a pressure of 4 oz. for gas appliances; Minneapolis-Honeywell Regulator Co. stated that an 8-oz. pressure advocated by Mortimer Jones would damage regulators and controls on central heating equipment,

"Better get a quote from ECLIPSE"

. . . FOR FAST SERVICE ON GAS COCKS

STANDARD—Eclipse iron body brass core construction serves better, longer. Individually tested at 125 lbs. and guaranteed as to gas-tightness, accuracy and alignment of tappings.



"RETAINED KEY" — Tamperproof construction . . . offers in addition the assurance that key will not be blown from or pulled out of the body even though the lock nut is removed or the tail piece snapped off.

Both types available for immediate, partial shipment, in flat head or lock wing style, black or galvanized finish.

. . . COMPLETE STOCKS OF RIGID METER BARS

STANDARD UNION, with standard type, gasket or ground joint union. Simplify and speed setting, give maximum protection to the meter. ALSO AVAILABLE WITH INSULATED UNION.

SLEEVE UNION, with threaded, one-piece sleeve union connections . . . no gasket required. Soundness and accuracy guaranteed.

COMPRESSION TYPE has threadless connection for "stab fit" of pipe. Gives maximum protection, plus new speed, flexibility and low cost meter settings.

All types available with or without integral gas cock (standard or "retained key") in wide range of sizes and styles.

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( ) Please send new Meter Bar Bulletin P-1
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( ) Please send samples for inspection and test.

Firm Name_____
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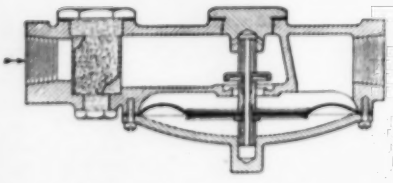
Don't Take Chances With

Gas-Oxygen Mixtures

Use NORWALK'S DIAPHRAGM OPERATED CHECK VALVE



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- Recommended where gas is mixed with oxygen. Prevents even smallest quantity of oxygen from entering gas lines.
- Glass Wool Filter prevents passage of foreign matter to valve or valve seat.
- Safely withstands back pressures up to 15 lbs.

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which are designed to operate on approximately 4-oz. pressure; raising the pressure probably would necessitate adjustment of a majority of the heating appliances in the city with the result of possible hazardous conditions; the number of complaints received by the city and the gas company does not justify raising the pressure.

Public Service workers go to work after 41-day strike

The strike of 1722 gas distribution and maintenance workers against Public Service Electric & Gas Co., Newark, N. J., was settled late in December, bringing to an end 41 days that cost strikers approximately $1,224,000 in wages and delayed installation of 10,000 meters throughout the state.

During the extended strike, service to more than 15,000 homes suffered when gas pressure was cut off or increased dangerously as a result of tampering. At one time, residents of two towns were routed from bed as authorities warned of the danger.

When work was resumed, crews concentrated on newly constructed homes throughout the state where installations of gas facilities was the only item preventing the owners from moving in.

Seattle Gas conducts pool on date of FPC line okay

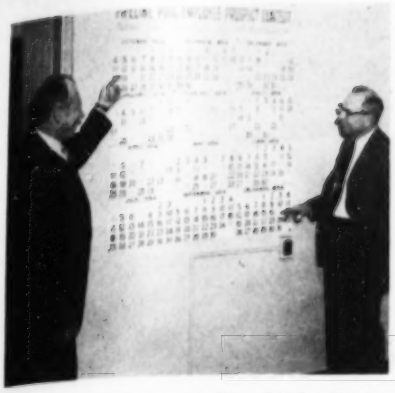
The day the Federal Power Commission's decision on natural gas for the Pacific Northwest is announced, some lucky Seattle Gas Co. employee will be *especially* happy—and $152 richer.

Patterned after the famous ice-breaking "Pool of the Yukon," an exciting "Pipeline Pool" contest held this fall helped build employee interest in the coming of natural gas to the area, and a good sales prospect list at the same time.

Employees "purchased" chances on the pool with sold prospects, who also netted them cash. Winner will be the person who guessed closest to the date of the FPC announcement.

Each sale to a prospect turned in by an employee automatically placed $1 in the pool, with a minimum of $100 guaranteed by the company. An additional $1.50 was credited to the employee's account and paid off just in time for Christmas on Dec. 17. The contest lasted 12 weeks, with progress reports stimulating interest in the swelling pool.

"The FPC hasn't broken the ice yet with a decision on natural gas," Norbert O. Fratt, Seattle Gas vice president in charge of sales, reported to employees at midway. "Gasco employees, however, have certainly been breaking the ice right and left. . . . It takes only one prospect sold to get a chance on the pool, and your guess is as good as anybody's. Why not get your prospect in today and get a share of this extra pay?" The re-



N. O. Fratt points out the chief optimist in the Pipeline Pool contest while President N. Henry Gellert calls attention to the leading pessimist. The calendar, which lists employees names on dates each selected as likely FPC-approval date, is prominently displayed to keep reminding employees of the eventual arrival of natural gas in the Pacific Northwest.

port was signed, "Ye Olde Pipeliner."

Later, "Right-o-way Engineer" Fratt reported at the three-quarter mark on the $108 pool with 2½ weeks still to go, and said: "Be sure to get YOUR CHANCE at the big money by pipelining your prospects to the sales department pronto."

Employee "guesstimates" on the FPC decision date ranged from Oct. 20, 1953 to Dec. 17, 1954, but the vast majority were concentrated in the three months of February, March, and April 1954.

Final results of the "Pipeline Pool" were 142 prospects sold, totaling 172 units with a dollar volume of $32,045.25. Thirty-nine employees held chances on the pool, and $152 awaits the lucky winner.

New Jersey Natural tells NAM of industry prospects

Based on the belief that management should be made aware of the areas still existing in the metropolitan area of the East where industries can locate, the New Jersey Natural Gas Co., Asbury Park, N. J., has sent a memorandum to the National Assn. of Manufacturers telling about industry's new beachhead located in New Jersey directly between New York City and Philadelphia.

In the memorandum, which was for distribution to the NAM membership, it was emphasized that there is an abundant supply of natural gas in Monmouth, Ocean, Middlesex, Cape May, and Morris counties.

Missouri Public Service would buy Gas Service Co.

The State Corporation Commission of Kansas, the Public Service Commission of Missouri, the City Council of Kansas City, Mo., officials of St. Joseph, Mo., and other interested parties are studying the proposed

Digs 4 to 5 Jobs Every Day

Hattendorf-Bliss meet heavy daily schedules of scattered jobs—regardless of soil and weather conditions—because their Clevelands *dig* them *on time, every time.*

Each extension crew of Hattendorf-Bliss, Inc., Cleveland, Ohio contractors, *completes* 4 or 5 jobs every day—trench dug, pipe laid, trench filled, job cleaned up. The jobs average 250-300 feet each, for 4, 6 and 8 inch pipe and require 10-15 miles of traveling through big-city traffic.

Hattendorf-Bliss have standardized on Clevelands for over 20 years. Currently the firm is working 9 Cleveland trenchers and backfillers for many types of trench work. In one 10-hour day, a Hattendorf-Bliss crew with one Cleveland trencher completed 11,000 feet—over 2 miles—of trench 19" wide and 30" deep for a 4" pipeline, including the crossing of a 20' stream.

"We go with Clevelands," say Hattendorf-Bliss, "because we know from experience they'll do every job we schedule them for. They stand hard usage and they're fast. Their full-crawler mounting and low bearing pressure protect lawns and sidewalks—we practically never have a damage claim. And because they're compact and easy to transport, we can really cover the distance between jobs with safety at good speeds."

Get the Full Story on Clevelands from Your Local Distributor

THE CLEVELAND TRENCHER CO.

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sale of the Gas Service Co., Kansas City, Mo., to Missouri Public Service Co. for $32 million.

If the transaction receives the sanction of the authorities, the name of the new utility would be the Midwest Public Service Co. B. C. Adams, president of Gas Service, would be president of the new company and Ralph J. Green, president of Missouri Public Service, would be chairman of the board.

The new organization would supply gas and electricity to 530,000 customers in 375 cities, towns, and communities in four states.

Modern home of GAS, showing the new two-story addition, which increases the office space of the company to 10,000 sq ft and gives frontage on three Los Angeles streets.

Gas Magazine increases office space

A new two-story addition to its main office building has been completed and occupied by Jenkins Publications Inc., publishers of *GAS*. This gives the company 10,000 sq ft of office space in a picturesque, three-level building of modern California design, with frontage on three streets—Alvarado, Miramar, and Mountain View—in Los Angeles.

On the ground level in the original building are the circulation department and a completely equipped employees' kitchen. The first floor is occupied by the editorial and sales staffs, in the original building, and by the art and production departments in the new addition. Administration offices and research are on the second floor of the new building. Covered garage space for management cars was provided by extending the upper floor of the new structure, on the Mountain View side.

Other Jenkins publications are the monthly magazines BUTANE-PROPANE News and WESTERN METALS; the annual BUTANE-PROPANE CATALOG; and technical books used internationally in the gas and liquefied petroleum gas industries, including the Handbook Butane-Propane Gases, Butane-Propane Power Manual, and The Bottled Gas Manual.

Scholarships offered for careers in gas utilities

Twenty scholarships, each worth $1090, have been established for chemical and mechanical engineering students preparing for careers in the utility gas industry by the Institute of Gas Technology at Illinois Institute of Technology, Chicago.

The scholarships are for study in the junior and senior years and one summer term.

The scholarships provide half tuition for each year, a total of $650. For the 12-week summer term, the awards cover the full tuition of $144 and a $300 stipend.

Houston Natural to open hospitality house

Houston (Texas) Natural Gas Corp. is combining community service with gas-appliance promotion in its new Hospitality House, which is expected to be completed by March 1.

According to Vice President L. P. Thomas, the facility will not only be used as an appliance-display center but the use of its auditorium will be offered to civic organiza-

GAS CLASSIFIED

Classified advertising is set in 6-point type, without border or display, at the rate of 15 cents per word per insertion; minimum charge per insertion $3. Box numbers for replies count as 5 words. Count as a word each one letter word and each group of figures. Classified advertising is only accepted when payment accompanies order. Copy and payment must reach publisher's office prior to 10th of month preceding publication.

WANTED—Industrial and commercial heating engineer for a natural gas utility. Donavan, Incorporated, 1725 Carroll Avenue, St. Paul 4, Minnesota.

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More than 80 Peacock Plants prove . . . *"There's No Substitute For Experience"*
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tions, women's groups, dealers, builders, etc., at a meeting place. There will be no charge for the use of the auditorium, but those attending the meetings will be asked to listen to a brief story on the advantages of having modern gas appliances in their homes and businesses. A representative of the home service department will be stationed at the center to give talks and demonstrations.

The building features a 40-ft, all-glass front. The appliance display section is at the front of the building. Up to 200 people can be seated in the auditorium.

Southern Union Gas to provide natural service

The Arizona Supreme Court affirmed the right of the Southern Union Gas Co. to provide natural gas service to five northern Arizona communities—Prescott, Williams, Flagstaff, Holbrook, and Winslow.

The court upheld a 1948 Prescott city election giving Southern Union a gas franchise. The action had been contested by the Northern Arizona Light & Power Co., now merged with Arizona Public Service Co. The tribunal disallowed a contention by the Winslow Gas Co. that service by Southern Union was in violation of Arizona's controlled-monopoly law.

News Notes

The Minnesota State Railroad and Warehouse Commission has advocated the broadening of its intrastate regulatory powers to include the fields of gas and pipelines. In its annual report, the commission declares that "various industries . . . have developed much faster than the adoption of regulatory law relating to such industries. For example, since the advent of gas and pipelines, there should be legislation enacted that would give the regulatory board in the state jurisdiction over the operation of these industries . . ."

For their "pioneer work in nuclear resonance at low magnetic field strengths," John P. O'Meara and William L. Rollwitz have been presented the first annual Judson F. Swearingen award for outstanding scientific research work at Southwest Research Institute. Both men are members of the institute's physics department staff.

The Housatonic Public Service Corp., formed by the merger of Derby Gas & Electric Co., Danbury & Bethel Gas & Electric Light Co., and Wallingford Gas Light Co., began operations on Jan. 1 in Derby, Conn. The three merged companies had been subsidiaries of Derby Gas & Electric Corp., a holding company now going out of business.

Construction is under way on a $500,000 plant expansion at the Anaheim (Calif.) division of the Robertshaw-Fulton Controls Co. The Anaheim division, one of seven Robertshaw-Fulton manufacturing divisions, is the only one devoted entirely to defense

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THE COMPLETE LINE FOR ALL Gas NEEDS
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Stylewise, Qualitywise and Pricewise The PEERLESS Line Is Best for Every Heating Requirement—For Small Homes, Apartments, Housing Projects, Defense Housing, Churches, Schools, Motor Courts, Stores, Offices, Shops.
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PEERLESS MANUFACTURING CORP., —— LOUISVILLE 10, KENTUCKY

CALENDAR

February

4..Instrument Society of America, 9th Annual Regional Conference — Hotel Statler, New York.
5..SGA Employee Relations Conference — Hilton Hotel, El Paso.
5..SGA Accident Prevention Conference — Hilton Hotel, El Paso.
8-12..Western Winter Radio-Television & Appliance Market — Western Merchandise Mart, San Francisco.
15-16..National Assn. of Purchasing Agents, Public Utility Buyers' Group Mid-Winter Conference—Lord Baltimore Hotel, Baltimore.
16..NEGA Accounting Division — Hotel Statler, Boston.
19..Florida - Georgia Gas Assn. Accounting Division — Daytona Beach, Fla.
23..SGA Transmission Management Conference — Shamrock Hotel, Houston.
24-25..SGA Distribution & Accounting Management Conference. Roosevelt Hotel, New Orleans.

March

1-5..American Society for Testing Materials Spring Meeting — Shoreham Hotel, Washington, D. C.
4-5..AGA Gas Supply, Transmission and Storage Conference —Jung Hotel, New Orleans.
15-17..Mid-West Gas Assn. Annual Meeting — Fort Des Moines Hotel, Des Moines, Iowa.
23-24..PCGA - AGA Domestic Gas Research & Utilization Conference—Ambassador Hotel, Los Angeles.
25-26..New England Gas Assn. Annual Meeting — Hotel Statler, Boston.
25-26..Oklahoma Utilities Assn. Annual Meeting — Biltmore Hotel, Oklahoma City.

April

12-14..AGA Sales Conference on Industrial & Commercial Gas — Edgewater Beach Hotel, Chicago.
12-14..National Conference of Electric & Gas Utility Accountants—Hotel Statler, Boston.
13-15..Southwestern Gas Measurement Short Course — University of Oklahoma, Norman.
15-16..National Personnel Conference of the Gas Industry—Edgewater Beach Hotel, Chicago.
19-20..AGA Residential Gas Section, Eastern Natural Gas Regional Sales Conference—William Penn Hotel, Pittsburgh.
19-21..AGA National Purchasing & Stores Conference — Henry Grady Hotel, Atlanta, Ga.
20-23..AGA Distribution, Motor Vehicles, and Corrosion Conference—Mount Royal Hotel, Montreal, Canada.
22-23..Indiana Gas Assn. Annual Meeting — French Lick Springs Hotel, French Lick, Ind.
26-28..Mid-West Regional Gas Sales Conference — Edgewater Beach Hotel, Chicago.
26-28..Southern Gas Assn. Annual Convention—Houston.

May

10-14..AGA Commercial Gas School Chicago.
10-14..35th Annual National Restaurant Convention & Exposition — Navy Pier, Chicago.
10-13..LPGA Convention — Conrad Hilton Hotel, Chicago.
13-14..Public Utilities Advertising Assn. — Hotel Statler, Boston.
17-21..National Fire Protection Assn.—Statler Hotel, Washington, D. C.
19-21..GAMA Annual Meeting — The Drake Hotel, Chicago.
24-26..AGA Production and Chemical Conference — William Penn Hotel, Pittsburgh.
27-28..Natural Gas & Petroleum Assn. of Canada — Prince Albert Hotel, Windsor, Ontario, Canada.

June

2-3..AGA Research & Utilization Conference — Hotel Statler, Cleveland.
20-24..Canadian Gas Assn.—Banff Springs Hotel, Banff, Alberta.
21-22..AGA Residential Gas Section, New York-New Jersey Regional Gas Sales Conference — Monmouth Hotel, Spring Lake, N. J.
28-29..Michigan Gas Assn.—Grand Hotel, Mackinac Island, Mich.

September

8-10..Pacific Coast Gas Assn. — Victoria, British Columbia.
17-18..Maryland Utilities Assn., Fall Conference — Virginia Beach, Va.
28-29..Texas Mid-Continent Oil & Gas Assn. — Baker Hotel, Dallas.

October

7-8..California Natural Gasoline Assn. Annual Fall Meeting. Ambassador Hotel, Los Angeles.
11-13..AGA Annual Convention — Atlantic City, N. J.
18-22..National Safety Council — Chicago.

November

8-11..American Petroleum Institute—Conrad Hilton Hotel, Chicago.

production. The new facilities will include two research and development laboratories, an auditorium, offices, and an employee cafeteria seating 250.

Philco Corp., Philadelphia, has announced the purchase of the Dexter Co., Fairfield, Iowa, manufacturers of home laundry equipment. Philco will continue operation of the Dexter Co. under its present management, of which Tom B. Hunt is president.

Selas Corp. of America, Philadelphia, has formed a new subsidiary, Selas Constructors Inc., Houston, to facilitate fabrication, erection, and service of Selas design and developments for the petroleum and petrochemical industries of the Southwest. The new subsidiary, formerly the Clare Construction Co., will be under the managership of R. T. Clare Jr., who will also be a vice president. K. W. Fleischer, manager of the fluid processing division of Selas, will be responsible for designs as engineering vice president of the new company.

Under terms of a measure introduced in the Rhode Island state legislature last month, bills of domestic consumers for natural or artificial, electricity, steam, water, and telephone service would be exempted from the Rhode Island state sales tax. A similar proposal was unsuccessfully sponsored by Rep. Harold E. Gavitt during the 1953 session.

Under a recently negotiated transaction, Lone Star Gas Co., Dallas, is taking over substantially all properties of Central Texas Gas Co., including distribution plants at Blanket and May in Brown county, interest in some 40 gas wells, and certain transmission lines. Central Texas will for 60 days continue to serve certain customers on its properties not acquired by Lone Star.

The United Natural Gas Co., Oil City, Pa., has received PUC authorization to purchase the Sykesville-DuBois Oil & Gas Co., Sykesville, for $22,000. The purchase will give United 440 more natural gas users in the area.

Conversion of gas appliances from manufactured to natural gas took place in Charleston, S. C., during the first two weeks of January. The conversion was originally scheduled for December, but according to Harold A. Petit, vice president and Charleston division manager of the South Carolina Electric & Gas Co., the company did not want to inconvenience customers during the holiday season.

Portland (Ore.) Gas & Coke Co. is accepting no new customers for gas space heating in large areas where the capacity of the company's distribution facilities has been reached. The company said the action was taken in the face of an increasing demand for gas for space heating and the fact that winter was bringing a high demand for gas.

GAS Transmission and Conditioning Section

Merger of Trans-Canada and Western assures eastern Canada of Alberta gas

The first large-scale export of natural gas from the province of Alberta is now practically guaranteed as the result of negotiations that have been taking place in the past three or four weeks. The line through which Alberta's jealously guarded gas supply would be tapped is a projected 2240-mile, $300 million tube to the eastern provinces, which would be a joint venture of a duet of erstwhile competitors that are now in the process of merging—Trans-Canada Pipe Lines Ltd. and Western Pipe Lines Ltd.

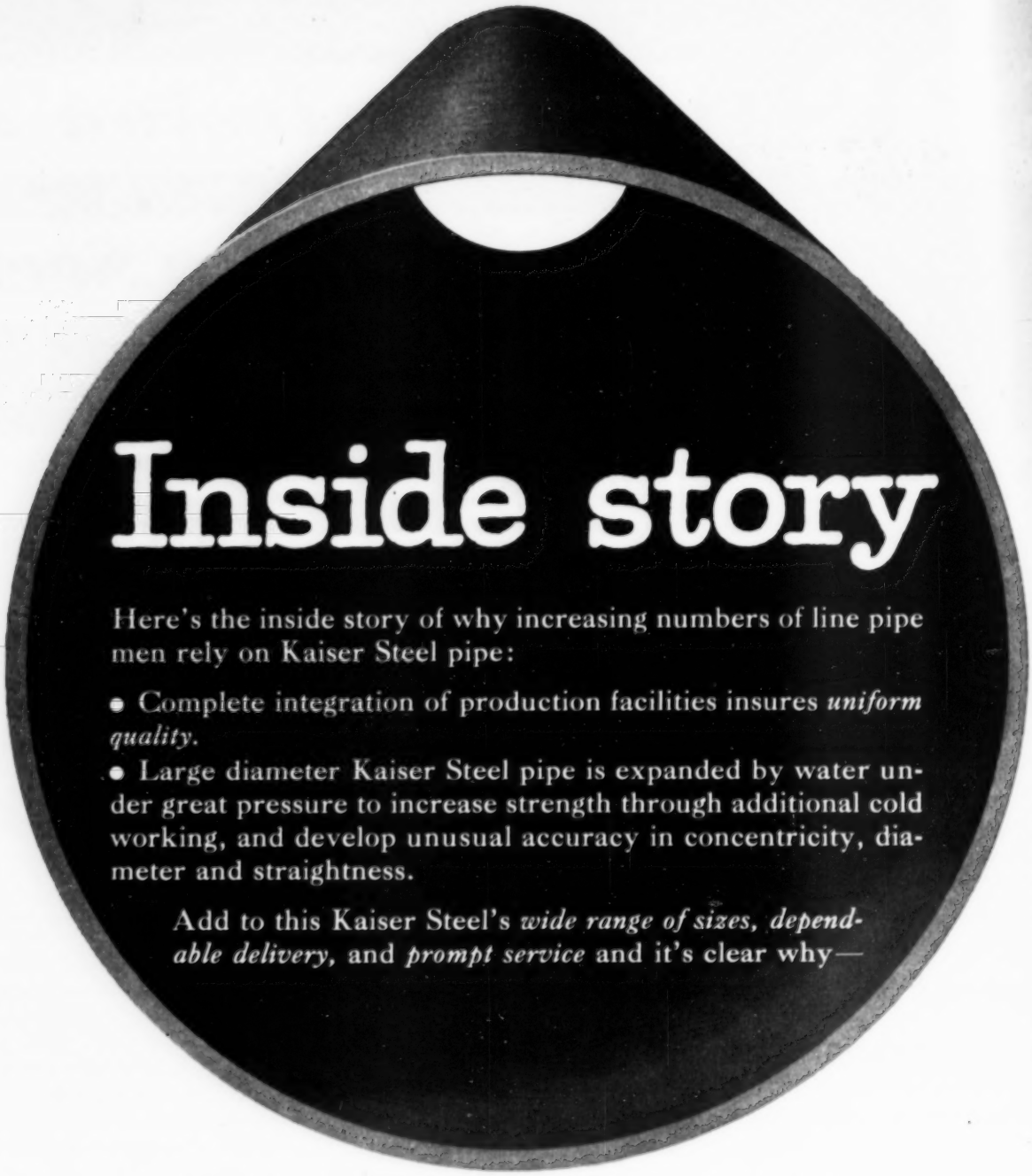
The merger is being accomplished at the urging of both Alberta and the dominion governments. The new company will acquire the name of Trans-Canada, and the route of the line will closely follow that company's original proposal. However, the plan whereby Western would run a line off from Winnipeg to the U. S. border, where gas would be transported by an American company to the Minneapolis market, has been retained as adjunct to the main Alberta-to-Ottawa carrier as now proposed. It would be built at a later date, however, and its construction would be subject to Federal Power Commission approval.

The merger plan represents a compromise between proponents of the all-Canadian route and those, such as Premier Manning of Alberta, who see the lush U. S. market as an excellent financial aid that will make the mainline more economically feasible. Because of the long hop across Canada's sparsely settled midriff, where markets are widely scattered, a government subsidy has been viewed as a likely necessity to make the proposed all-Canada line pay out.

Construction details are still far from firm. One of the first questions that still needed solving at press-time was the optimum diameter. Both 30-in. and 36-in. pipe sizes were under consideration, the former looking more economically attractive during the initial stages of operation and the latter appearing to be less costly over the long pull.

It is expected that, if financing plans and other details can be worked out rapidly, construction can begin this summer.

The new Trans-Canada had not as yet firmed up its corporate organization, according to late reports. The well-known Clint Murchison of Texas, president of Delhi Oil Co., headed up the original Trans-Canada company. H Ray Milner of Edmonton, Alta., and A. H. Williamson and Gordon P. Osler were principal officers in Western. Murchison, Milner, Williamson, and Frank A. Schultz of Trans-Canada are principal members of a board of directors and management committee which will operate the company temporarily.



Inside story

Here's the inside story of why increasing numbers of line pipe men rely on Kaiser Steel pipe:

- Complete integration of production facilities insures *uniform quality.*
- Large diameter Kaiser Steel pipe is expanded by water under great pressure to increase strength through additional cold working, and develop unusual accuracy in concentricity, diameter and straightness.

Add to this Kaiser Steel's *wide range of sizes, dependable delivery,* and *prompt service* and it's clear why—

It's good business to do business with

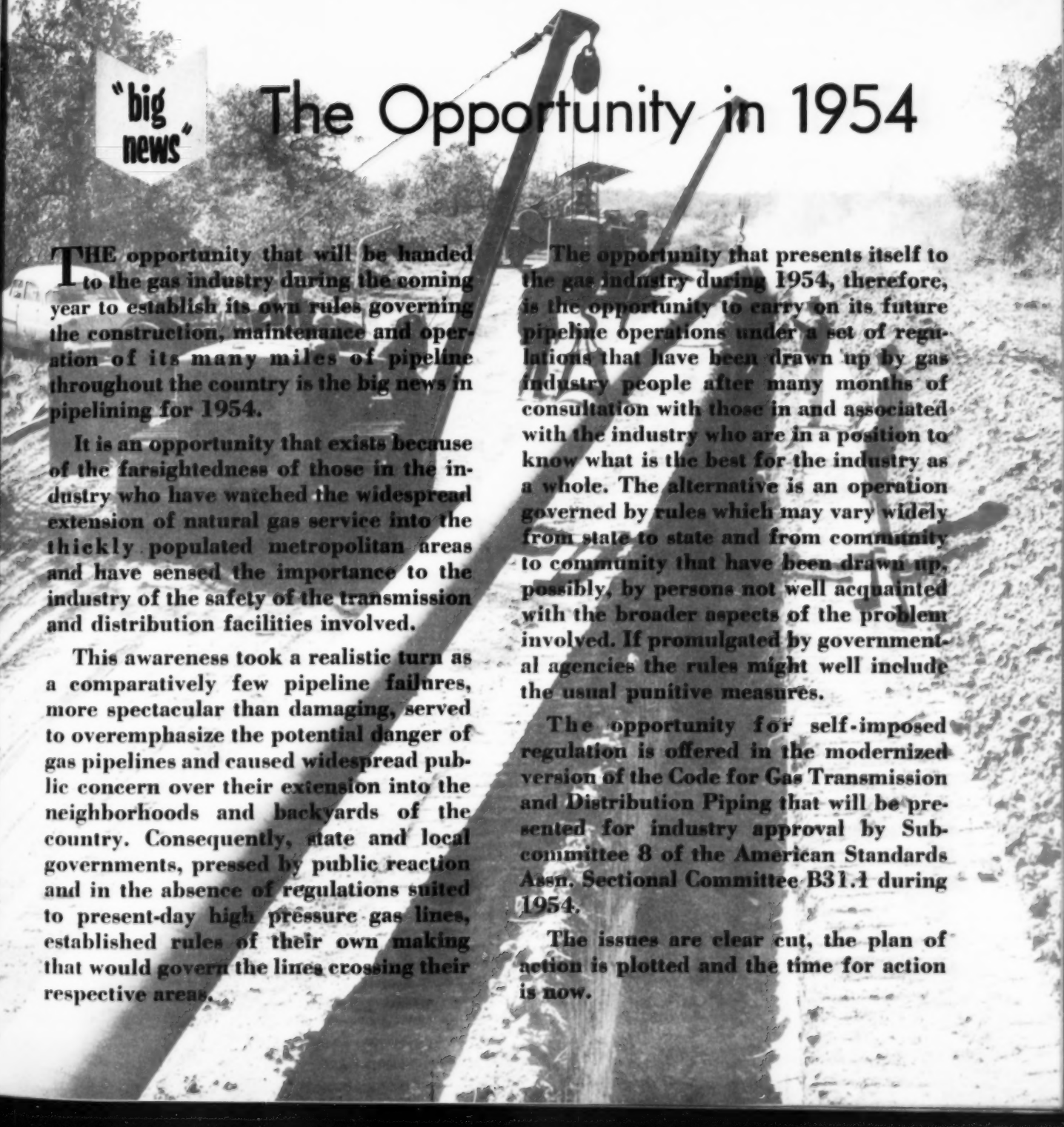
Kaiser Steel

KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	14" to 18" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	20" to 30" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser

Prompt, dependable delivery at competitive prices • KAISER STEEL CORPORATION Los Angeles, Oakland, Seattle, Portland, Houston, Tulsa, New York

GAS Transmission and Conditioning Section



"big news"

The Opportunity in 1954

THE opportunity that will be handed to the gas industry during the coming year to establish its own rules governing the construction, maintenance and operation of its many miles of pipeline throughout the country is the big news in pipelining for 1954.

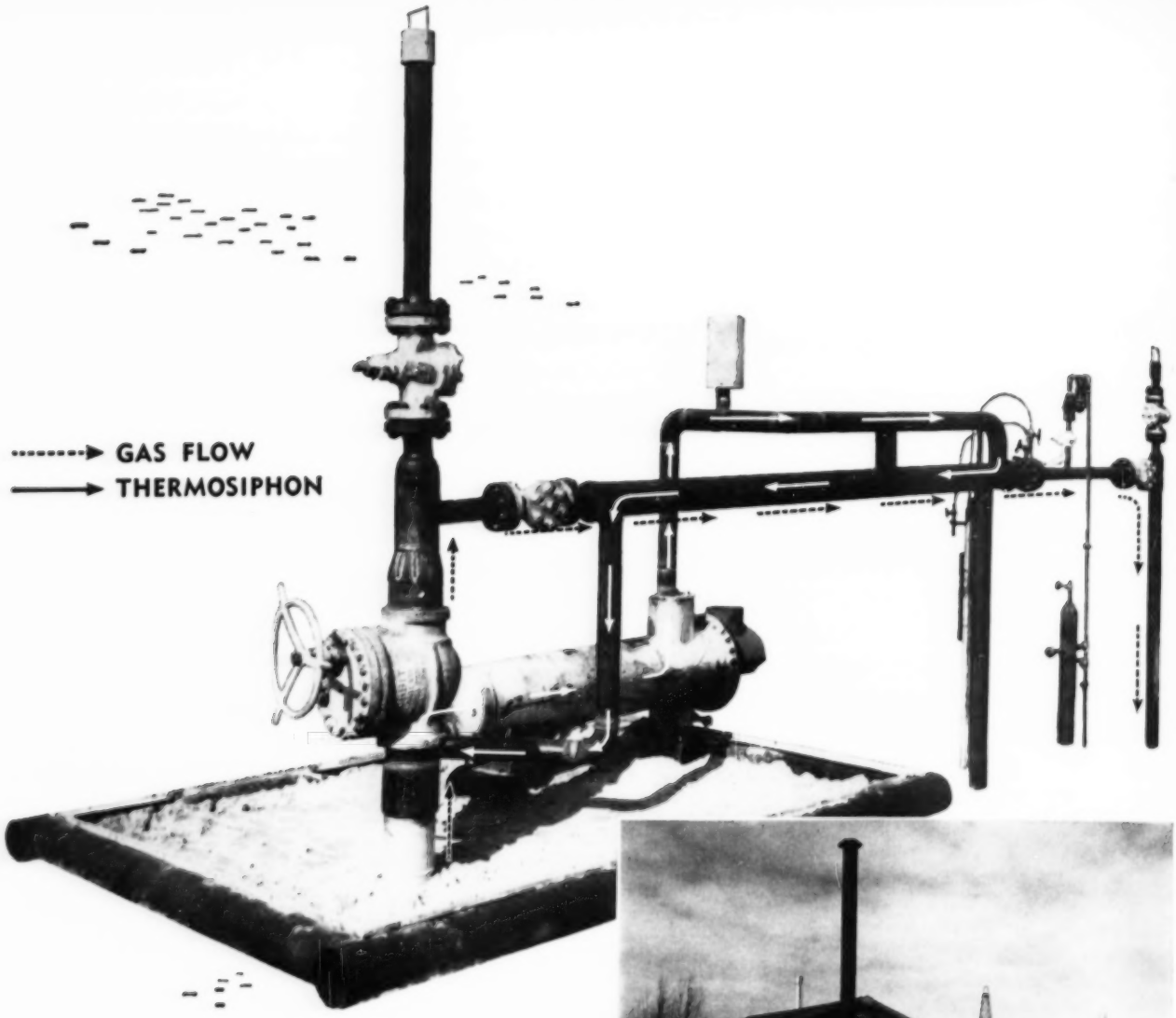
It is an opportunity that exists because of the farsightedness of those in the industry who have watched the widespread extension of natural gas service into the thickly populated metropolitan areas and have sensed the importance to the industry of the safety of the transmission and distribution facilities involved.

This awareness took a realistic turn as a comparatively few pipeline failures, more spectacular than damaging, served to overemphasize the potential danger of gas pipelines and caused widespread public concern over their extension into the neighborhoods and backyards of the country. Consequently, state and local governments, pressed by public reaction and in the absence of regulations suited to present-day high pressure gas lines, established rules of their own making that would govern the lines crossing their respective areas.

The opportunity that presents itself to the gas industry during 1954, therefore, is the opportunity to carry on its future pipeline operations under a set of regulations that have been drawn up by gas industry people after many months of consultation with those in and associated with the industry who are in a position to know what is the best for the industry as a whole. The alternative is an operation governed by rules which may vary widely from state to state and from community to community that have been drawn up, possibly, by persons not well acquainted with the broader aspects of the problem involved. If promulgated by governmental agencies the rules might well include the usual punitive measures.

The opportunity for self-imposed regulation is offered in the modernized version of the Code for Gas Transmission and Distribution Piping that will be presented for industry approval by Subcommittee 8 of the American Standards Assn. Sectional Committee B31.1 during 1954.

The issues are clear cut, the plan of action is plotted and the time for action is now.



GAS UTILITY USES 225 NATIONAL HEATERS... SAVES $900 PER MONTH

SITUATION — Underground natural gas storage area in Central Michigan underlying 25 sections of land. Input pressures range from 307# psi to 700# psi. Gas is dehydrated before storage.

PROBLEM — To find a heater

1. That would give a 35 degree temperature rise to a gas stream whose maximum flow would be 500,000 cu ft. per day.
2. That was small enough to fit in a small house covering both the wellhead and the heater.
3. That would operate at maximum efficiency since all gas consumed in the heater cost approximately 30 cents per thousand cu ft. at the wellhead.

RESEARCH — Several types of "home-made" and commercial heaters were tried along with National's 16" x 6', Model CA124 Horizontal Heater.

RESULTS — By actual fuel consumption tests, using identical hook-ups, National's heater outperformed all others using exactly one half as much fuel as the competitive models. The gas utility shows a savings of $900.00 per month, based on a 12-month gas expense period. These savings are based on actual tests. They are effected by using 225 National 16" x 6' direct heaters — indirectly — in this one area.

It's a National

NATIONAL TANK COMPANY

TULSA, OKLAHOMA

Field and laboratory method for

INVESTIGATING CORROSION

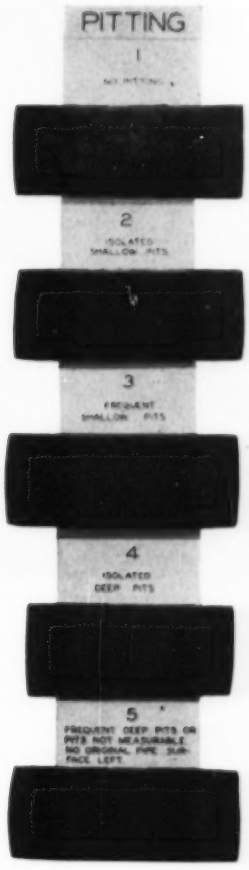


Fig. 1. Corrosion specimen panels (left and right) are helpful in providing crews with corroded specimens of different classes so that they will have something for comparison.

By J. B. ARMSTRONG

Standard Oil Co. of California

DURING World War II, shortages of steel products and alloys started the oil industry on an intensive study of its corrosion problems. Prior to that time, oil field corrosion received only scattered attention in research laboratories, with emphasis being placed on corrective measures, particularly on corrosion-resistant materials of construction. During the war, corrosion-resistant alloys were unavailable. Oil producing companies encountering the high cost of tubing and rod replacements in oil wells, organized corrosion committees and initiated research programs in an effort to learn more about these problems and to find methods of minimizing the corrosion.

We, in gasoline plant operations, have been somewhat slow in maintaining our share of the progress, partly because our problems were not as costly, and partly because we had employed corrosion-resistant materials of construction to limit our corrosion problems. We have also built high factors of safety into our lines and vessels which gave them longer life and made the corrosion problem appear less severe than it was in actuality. It has been only recently that the operators have begun to find out just how much the problem of corrosion is costing in gasoline plants. We have always had the problem. We have lived with it. We have failed, in most cases, to keep sufficient records to tell us the whole sad story.

In making an investigation of potential corrosion problems and evaluating the merits of inhibitors or other corrective measures, the engineer has at his disposal certain field and laboratory techniques. In putting them to use, he must answer these four questions:

1. How severe is the corrosion problem, both from the economic point of view and from the safety point of view?
2. What is the basic cause of the corrosion?
3. What can be done to combat it?
4. How effective and how costly is the treatment?

The answer to these questions can be obtained by making corrosivity and inhibitor evaluations.

The corrosivity evaluation

Evaluation of the corrosivity of a system is made on the basis of past history and plant maintenance records, visual and instrument inspections, corrosion rates established by test coupons and iron counts, and by various other chemical tests to indicate the presence of known corrosive gases. The history includes a record of failures and replacements, and an economic analysis should be made from the cost of these replacements. Records of safety hazards and personnel injuries should also be made. Classification of the severity of corrosion, from the economic and safety standpoints, can be made on the basis of these records.

The engineer, however, finds that in many cases there are almost no records —only those which the plant and maintenance foremen carry in their heads, and records based on memory are not reliable. In such cases, the history and maintenance data must be started from scratch and records kept as the investigation continues. In any problem, the only positive means of evaluating corrosion and inhibitor effectiveness is to maintain a complete story on the system.

Visual and instrument inspections

In locations where corrosion is known to occur and particularly where a safety hazard may be involved, periodic inspection of the piping and equipment should be scheduled. This can be done during shutdowns, when making equipment replacements; or while operating, by use of thickness-indicating instruments. Plant and maintenance repair men should

This article is adapted from a paper presented at the annual meeting of the California Natural Gasoline Assn. in Los Angeles, Oct. 8-9.

A section of Buckeye Pipe Line Company's dispatching center, which controls an intricate system of crude oil lines by teletype. William Flannery, at the teletypewriter, is communicating with a station on a change in pumping orders. J. R. McNeff, Chief Oil Dispatcher, talks with J. D. McCullough, Supt. of Communications, right.

Bell System Service helps Buckeye Pipe operate smoothly

Buckeye Pipe Line Company moves hundreds of thousands of barrels of crude oil and refined petroleum products daily in seven states. To keep lines operating smoothly, the company relies on 3000 circuit miles of Bell System Teletypewriter Service.

"The reliability of this service has been *99.5%*!" reports J. D. McCullough, Superintendent of Buckeye Communications.

This remarkable record of reliability has paid big dividends. Mr. McCullough adds:

"It has resulted in increased efficiency, considerable economy, and has maintained our reputation as a dependable, efficient carrier."

Bell System communications are an economy no pipeline operator can overlook. When you can get Bell System reliability, why tie up capital in communications equipment or set up reserves for maintenance and obsolescence?

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be told what information is desired, and they should report on all systems where they find corrosion occurring. It is helpful to provide these crews with corroded specimens of different classes so that they will have something for comparison. An example of this is shown in *Fig. 1*. This panel is used by the maintenance crews of one company so that they can give a relatively accurate report on what is found. The corrosion engineer can then keep abreast of the problems by reviewing these reports.

Thickness-indicating instruments

Where the corrosion causes a possible hazard and periodic inspection is required between shutdowns, thickness-indicating instruments are used to follow the rate of corrosion. There are three general types of instruments for making wall thickness determinations of lines or vessels:

1. Gamma ray instrument or Penetron.
2. Resonance-type ultrasonic instruments.
3. Echo-type ultrasonic instruments.

The Penetron was first built by the Texaco Development Corp. and is now commercially available.* Penetron service is also available through consulting engineers in some localities. This instrument employs the penetrating power of gamma radiation to measure metal thickness. Gamma rays from the sources are directed through the material being measured into a counter. The source employed is approximately one milligram of a commercially available radium salt. The source is surrounded with a shield containing a window which directs the beam of gamma rays in the desired direction. The intensity of radiation at the counter is reduced by absorption in the material being tested. The amount of this reduction depends on the density and thickness of the material. The counter and electronic circuit convert the resulting intensity of radiation into a direct current which is read on a microammeter. A thickness measurement is obtained by comparison of this reading with a calibration curve.

The Penetron measures the average wall thickness of an area of from 1 to 3 sq in., depending on the size of pipe and type of head being used. The instrument gives an accurate determination of metal thickness when the surfaces are fairly uniform and where the corrosion has resulted in general thinning of the metal. Since the result is the average thickness of about 1 to 3 sq in., the instrument will not indicate isolated or infrequent pitting. The accuracy is also somewhat affected if the metal is backed by scale, corrosion product, or liquid, and for best results lines should be drained when measurements are being made. This type of instrument will not indicate laminations or flaws in the metal and, consequently, can be used to measure total thickness of laminated or lined vessels.

There are several resonance-type ultrasonic thickness-testing instruments available for the industry. One of the most commonly known is the "Audigage." These instruments measure thickness of materials by reflection of sound waves. In operation the instrument emits, through a quartz crystal, a high frequency sound wave which passes through the metal being measured and then reflects in sound waves from the back surface. When the transmitted and reflected sound waves are in phase, the thickness can be determined by a formula based on the speed of sound and the frequency in the particular medium which causes resonance.

These instruments determine an average thickness of the area under the crystal, which may vary in diameter from ⅜ in. and larger. Accurate thickness measurement can be made on fairly uniform surfaces. The results will detect laminations in the material and are not affected by liquid or corrosion products backing the metal. The instrument will measure only the outer layer of metal in these cases. This type of thickness gauge is the least expensive of the thickness-measuring devices discussed here and has been widely used in oil refineries.

The echo-type ultrasonic gauge[1] has recently been experimentally used in the gas industry. Some development work is still being carried on, however, and the equipment is not yet available.

This instrument determines the thickness of metal by measurement of the time taken for an ultrasonic wave to travel to the back surface of the material and return to the crystal. For this measurement the instrument employs higher ultrasonic frequencies and a special radar type circuit. The ⅛-in. diameter crystal used will accurately indicate pitting, depth of pit, and any laminations in the vessel. Corrosion products or liquid behind the material do not affect measurements.

The continuation of development work on this type of instrument is being directed toward making rapid scanning of pipe or vessels possible. At the present time only that area of pipe under the crystal is measured with any of these instruments, and covering large surface areas, without prior knowledge as to where the corrosion might be occurring, is costly and time consuming. In the hands of an engineer, however, who knows their values and limitations, these instruments are a useful aid in investigation of many corrosion problems and in reducing the hazard to plant personnel where failures might occur if corrosion progresses too far.

These instruments can also be employed to establish corrosion rates before and after treatment as a means of evaluating inhibitor effectiveness.

Test coupons

Measuring the corrosion rates of iron test coupons installed in a corrosive system gives the engineer another valuable tool for use in a corrosion investigation and for evaluating effectiveness of inhibitors. Coupon corrosion rates are not an absolute measure of the rate at which piping and equipment is actually corroding; however, comparison of results with those of other systems or comparison of rates before and after treatment enables the engineer to evaluate the problem more thoroughly.

The use of coupons is limited. Installation of a coupon in a flowing stream may change the turbulence in the system and result in different corrosion rates at this point. Varying velocities and turbulence have considerable effect on corrosion rates. It is also not always possible to install the coupon in just the right location, and it is often hard to reproduce results.

Iron test strips, ½ in. x 3 in. or 1 in. x 3 in., SAE 1020 hot rolled steel, are generally used for coupons. Test strips are easily handled and can be installed in a system through a packing gland arrangement without a shutdown. Rod coupons, test nipples, spools, or sleeve coupons may also be employed. Test nipples and sleeve coupons are better than strips but are often hard to install and remove. If they are installed in a regular flow line, the installation requires a shutdown. If they are placed in a bypass line, flow conditions may not be the same, and the corrosion rate may vary accordingly.

Test coupons may be prepared prior to weighing by (1) electrolytic cleaning, (2) acid etching, or (3) sand blasting plus degreasing with carbon tetrachloride. The simple sand blasting treatment has been found to give more reproducible weight losses than do the other meth-

*For more complete information on the Penetron and how it works, see "The Penetron—Its Application in the Gas Industry," by B. I. Dikmen and O. W. Graham, *GAS*, March 1947, page 34.

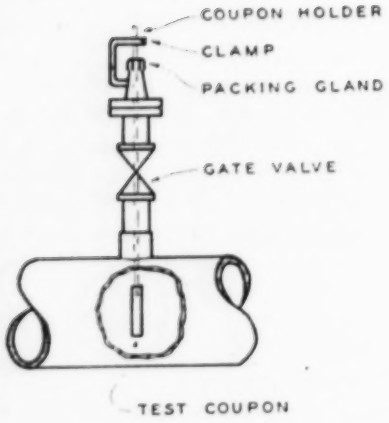

Fig. 2 (above). Coupon installation into a flow line through packing gland.

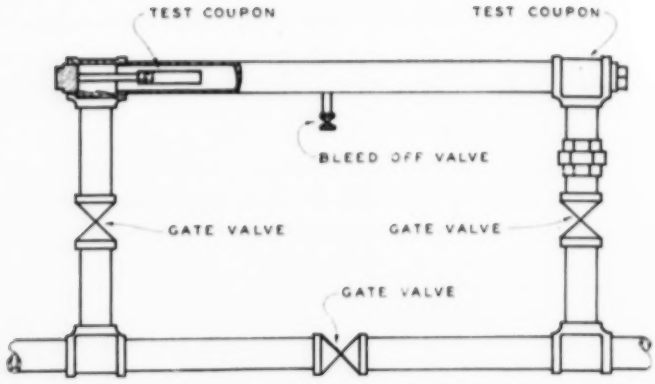

Fig. 3 (left). Coupon installation in a bypass arrangement on a liquid flow line.

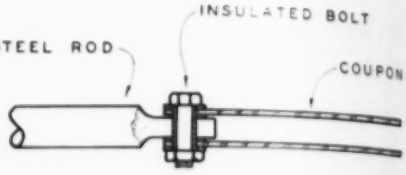

Fig 4 (right). Test coupon holder, showing method of insulating coupons from the holder when installed.

ods which have been previously used. Some work has also been done experimentally, blasting with fine aluminum oxide, and results indicate that this method may give even more reproducible results than blasting with fine sand.

After preparation, coupons are weighed and stored in a desiccator until installed in the system. Care should be taken during preparation and installation not to touch the coupon, since oil from the skin on the surface of the metal will affect its corrosion rate. Coupons should be installed in a system in a relatively non-turbulent zone. Turbulence causes channeling on coupon surfaces and gives greater weight losses than would result from corrosion alone.

Since test specimens are placed in a system where the corrosion is due mainly to an acid effect, they should be electrically insulated from the line and from each other in order to eliminate any possible galvanic effect created by installing the coupons. If the corrosion in the system is due to a galvanic effect where the anode and cathode are separated, it is best not to insulate so as to obtain the full effect of the corrosive action. In this case, however, when galvanic effects lead to pitting, the true severity of corrosion cannot be determined from weight loss of coupons.

Figs. 2 and *3* show two methods of installation of coupons. *Fig. 2* shows installation of coupons through a packing gland into a gas flow line. *Fig. 3* shows an installation in a bypass liquid line. As many as four coupons can be installed at one time by this method, permitting removal of the test specimens at different intervals of time. *Fig. 4* shows the method of insulating coupons from the holder when installed.

Coupons are generally left in the system for two to four weeks. When they are removed at the conclusion of the test, they should be wiped with a cloth and placed in a bottle containing acetone or light oil. This prevents further corrosion by contact with air while they are being transported to the laboratory for cleaning and weighing. Exposed coupons are cleaned by scrubbing with kitchen cleanser, rinsed with water, and dried by dipping in acetone and blowing with air.

Coupon corrosion rates are calculated from the weight loss during the exposed period and are expressed as surface penetration in mils per year (1 mil = .001 in.). Weight loss can also be computed as pounds of steel loss per 1000 ft of pipe to check data obtained by iron count.

In addition to checking corrosion rates and determining inhibitor effectiveness, coupons may be fabricated from different alloys to aid in evaluation of alloy materials in construction of vessels, coolers, and other equipment for corrosive service. The NACE* in connection with the NGAA† condensate well corrosion committee made surveys a few years ago, in which 32 alloy coupons were installed in spools in condensate well flow lines to obtain data on the corrosion resistance of different metals in this service.

Iron counts

A measure of the iron content (iron count) in the condensed water in the system presents another means of determining corrosion rates and evaluating the effectiveness of inhibitors. The amount of iron being carried out of a system is a direct measure of the rate at which the steel equipment is being corroded. Iron concentrations are determined in the laboratory by colorimetric test during either the thiocyanate or thioglycollic acid methods. Iron counts are reported as ppm of iron in the water sample. To get a true rate of corrosion, it is also necessary to get a measurement on the volume of condensed water and calculate the total weight of iron being removed from the system. This result can then be compared with determined coupon corrosion rates.

Iron counts are of much more value when determinations have been run periodically for several weeks rather than relying on a few isolated tests. Periodic tests also make it possible for the engineer to follow the changes of corrosion rate due to uncontrollable variables in the system.

Because of these uncontrollable variables in the system and difficulties in sampling, information obtained by iron count is not always reliable. Some of the difficulties which are encountered and which result in incorrect iron counts can be traced to the following:

1. Nonrepresentative sampling.
2. Improper treatment of the sample in the field.
3. Loss of iron by solution in the hydrocarbon liquid phase or by suspension in an emulsion layer between the water and hydrocarbon phases.
4. Reaction of ferrous iron with oxygen or other gases in the system which results in a precipitation of iron from the water prior to sampling.

The problem of obtaining a representative sample is important and not an easy one. However, the variables involved in sampling can be controlled if

*National Assn. of Corrosion Engineers.
†Natural Gasoline Assn. of America.

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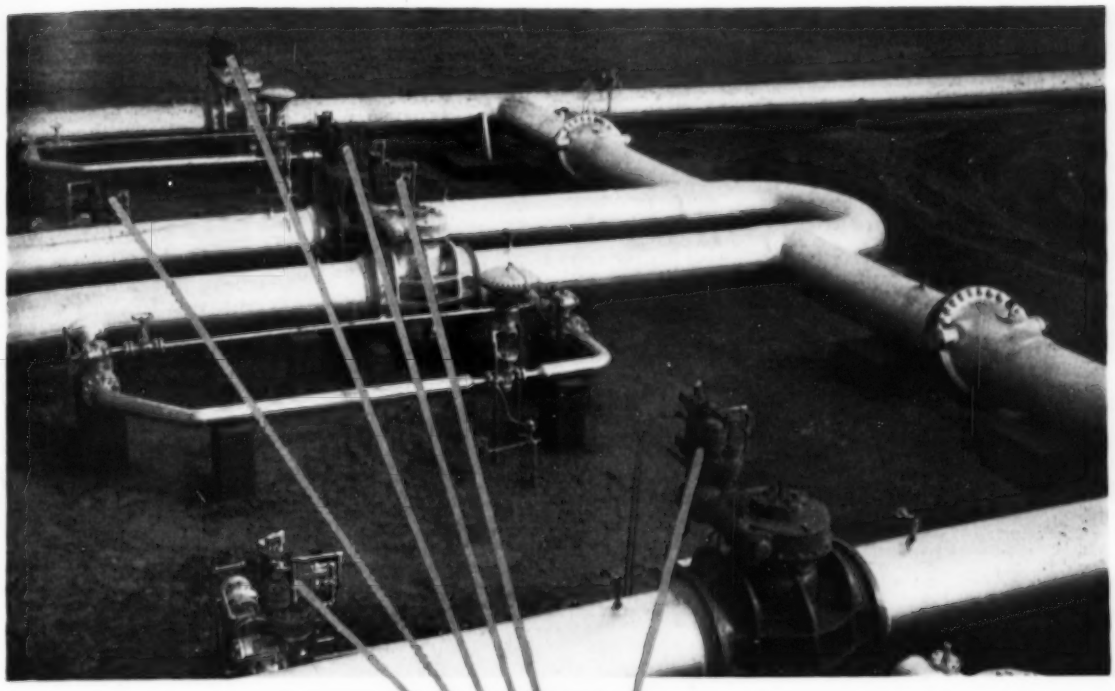

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proper methods are followed. The engineer should supervise the sampling and insist on necessary precautions to obtain good samples. Since iron precipitates quite rapidly from solution after coming in contact with air and is not too readily redissolved, acid should be added to the sample bottle before sampling. This will keep the iron in solution until the analysis is run in the laboratory.

When the volume of hydrocarbon condensate is relatively large, or when an emulsion layer is encountered, checks should be made for iron content of these layers. If any is present, then this iron must also be determined and added to the iron content of the water phase. Some organic inhibitors tend to bring the iron into the hydrocarbon phase, which increases this difficulty.

When oxygen or hydrogen sulfide is present in the system, precipitation of the iron from solution may occur before sampling. This cannot be controlled and should be taken into account when evaluating iron counts. When corrosion products are present as solids in suspension in the condensed water, the iron count should not be used as a means of evaluating corrosion.

Additional data

There are a number of chemical analyses that are also employed by the corrosion engineer to aid in his investigations. These are all published in the literature, and details will not be given here.

Tests should be conducted to establish the condensed water composition and to check the carbon dioxide, free oxygen, and hydrogen sulfide content of the gas. Additional tests may be run to show the presence of mercaptan sulfur and organic acids. From these analyses pH of the condensed water under operating conditions can be estimated. When using inhibitors, a test to check inhibitor concentration is also advantageous.

When a relatively large volume of hydrocarbon liquid is being handled, it is also helpful to know the wetting properties of the hydrocarbon. This can be determined by the drop-size ratio test developed by the NGAA condensate well corrosion committee.

It has been assumed that the corrosion problem is an internal one caused by the acid gases in the natural gas systems. It may be that the corrosivity evaluation will indicate galvanic corrosion or corrosion due to stray currents; or that the problem is a metallurgical one, such as improper heat-treating, in which case additional tests will be conducted along these lines. These will not be discussed here because they are specific problems and not general throughout the industry.

Tests employed in connection with cathodic protection and protective coatings of buried lines, also, are not discussed since these measures are established and are effective.

Inhibitor evaluation

There are a number of methods which are employed in laboratories to obtain quick evaluation of corrosion inhibitors. The main purposes of these tests are (1) to show which inhibitors are sufficiently effective to be tested in field operating systems, (2) to indicate the effect of concentration on inhibition, and (3) to determine the effectiveness of given inhibitors under a variety of conditions.

Discussion of all published methods would be too involved to be handled satisfactorily in a study such as this. Many of these methods have advantages over the others. However, in order to show what can be done in the laboratory, three different methods will be discussed briefly.

In a paper presented at an annual meeting of the NACE, Ryznar and Green[2] discussed the use of a rotary rod coupon to study corrosion and inhibition. A .25-in. diameter, 1020 mild steel coupon is rotated at constant speed in a corrosive water for 24 hours. During this time, potential measurements are made at suitable intervals, and at the completion of the test an iron count is run on the water. Results are evaluated on the basis of visual inspections, potential data, and iron counts. Results are easily reproducible. This method can be used to study the effect of variable velocities (by changing the speed of rotation), temperatures and corrosive medium, and to evaluate inhibitors.

Measurement of the surface potential of a coupon as a means of studying inhibitors has been done by means of a "Rotogenerative detector."[3]

This apparatus is essentially a detector of local action currents. A cylindrical coupon is rotated at a controlled speed in a corrosive solution. Opposite the coupon is a fine tipped electrode with a variable distance between the electrode and the coupon which may be as low as .001 in.

As the coupon rotates under fixed conditions, the average potential of points on the surface adjacent to the electrode is measured by means of an electronic circuit. The effect of inhibitors on the rate of corrosion of the coupon can be determined by these measurements. The apparatus can be used to study effect of inhibitor concentrations and the persistency of the protective film.

Scott and Rohrback[4] have employed the measurement of hydrogen evolved during corrosion as a means of evaluating inhibitors. A cylindrical coupon is rotated in a flowing corrosive solution. The gas and liquid leaving the coupon are separated and the amount of hydrogen in the gas stream is determined by means of a thermal conductivity cell. This provides a means of continuously measuring the rate of hydrogen evolution and, consequently, the corrosion rate. The effect of an inhibitor on this rate is studied by injecting it into the flow stream in front of the coupon and recording any change in the rate of hydrogen evolution. This method is advantageous because of the short time it takes to make a test. The method can be used to study (1) the rate of reduction of corrosion when inhibitor is added, (2) the effectiveness of different concentration of inhibitors, and (3) the persistency of the inhibitor protection when injection is stopped.

Inhibitors which show good protection by one or more of these laboratory tests are then tested in a corrosive plant operating system. Pumps, lubricators, or pressure feeders may be used to inject the inhibitor into the field system. Visual and instrument inspections, coupon corrosion rates, iron counts, and chemical tests for inhibitor concentration are employed to initially establish optimum treatment and to follow progress of the test over a period of months. Complete evaluation of the inhibitor effectiveness must be made on the basis of plant maintenance cost data before and after treatment and on the elimination of safety hazards.

Only by continued efforts on the part of the corrosion engineer and all plant maintenance and operating personnel can the corrosion control program be made effective. By the combined effort of these people we will finally be able to say, "we have reduced plant costs due to corrosion, and we have made the plant a safer place to work."

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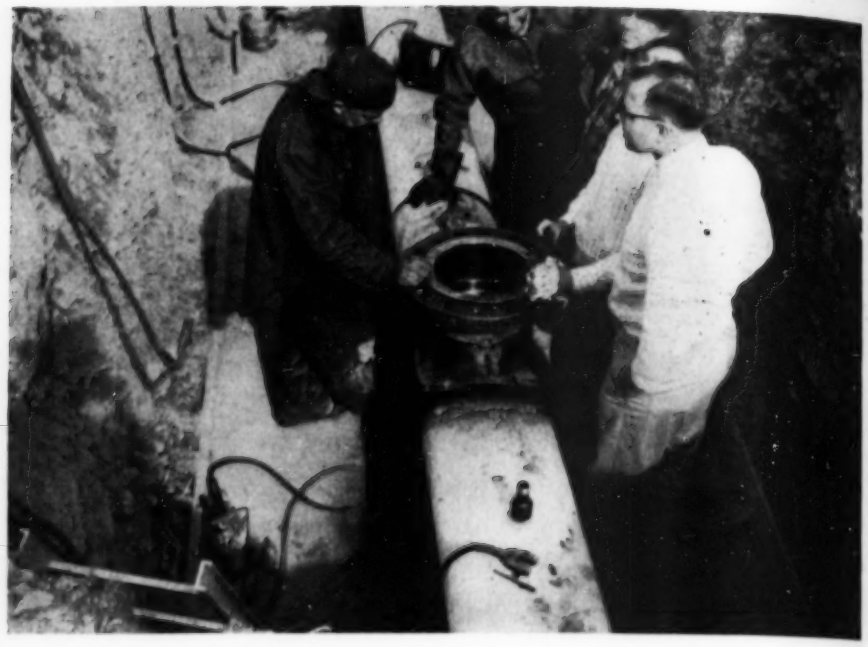


Fig. 2. View of 16-in. by 12-in. reinforcing saddle used to give additional support to special nipple.

Fig. 1. 12-in. Williamson special nipple prior to welding on 16-in. pipe.

Complete meter run eliminate

By **ARMAND F. HOEHLE** • Equitable Gas Co., Pittsburgh

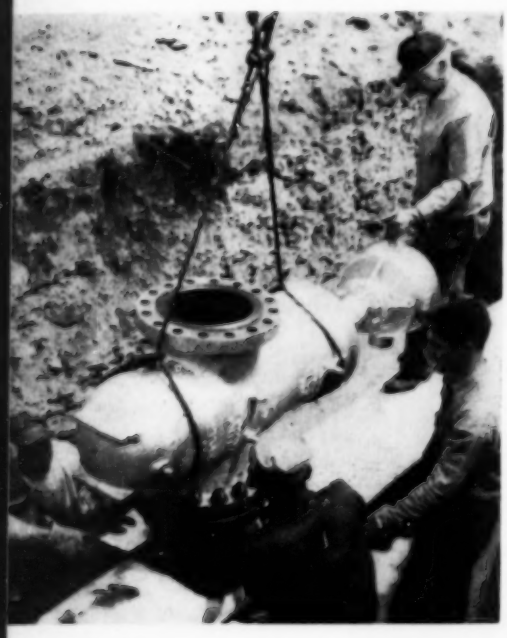


Fig. 3. 12-in. H.P. full opening gate valve through which orifice plate was installed.

IN keeping with the company's policy of public safety, a construction program was recently completed in which all gas entering the distribution system of the metropolitan area is now being odorized.

To implement such a plan, it was deemed advisable to standardize on the equipment insofar as possible; thus the Peerless odorizer was selected after considerable study. Although field condition and connections varied, certain basic engineering requirements were common to all units.

Differential needed

The operation of this type of odorizer is dependent upon the creation of a differential in the gas flow stream to be odorized. This objective can be accomplished in the most practical manner by installing an orifice plate in the line to give the proper differential pressure of 1 in. to 100 in. of water to allow the odorizer to operate properly under varying conditions of flow and pressure.

At the Bradford Woods station, where gas is taken from the Tennessee Gas Transmission Co., it was found by computation that an 8¼-in. orifice plate in the 16-in. line with pressure taps 2½ diameters upstream and 8 diameters downstream respectively, would give the proper differential under existing conditions.

To avoid making a complete orifice meter run with a valve in the 16-in. mainline and a 16-in. orifice meter run with two valves and a standard orifice flange, it was decided to use a Williamson orifice plate which could be installed in the 16-in. mainline by welding a 12-in. Williamson nipple *(Fig. 1)* on the line with proper reinforcement *(Fig. 2)*. After the nipple was welded, a 12-in. full opening gate valve was bolted to the flange *(Fig. 3)* and a Hillco tapping machine *(Fig. 4)* was used to drill and remove the coupon from the 16-in. pipe. Upon removal of the coupon, an insertion tool *(Fig. 5)* was used for the installation of the orifice plate.

Opens after insertion

The orifice plate *(Figs. 6* and *7)* is designed to open up into the line after insertion giving the approximately 8¼-in. orifice, and while the sides of this plate are not 90° to the 16-in. pipe,

it was still felt that a sufficiently accurate differential could be obtained to produce the desired results.

The welding of the Williamson nipple and the tapping of the hole into the mainline was done under pressure and without incident. However, when the orifice plate was installed, it would not open up the first time because of the welding procedure having pulled the 16-in. line slightly out of round. The orifice plate was removed and returned to the Williamson Co., who carefully fitted it to a short section of 16-pipe, duplicating the out of roundness of the mainline. Later the entire device was installed successfully under 300-lb line pressure, and the plate opened up to its proper position, giving us the 8¼-in. orifice as planned.

Using the 2½ and 8 diameter pipe taps as mentioned above and under the

Fig. 4. Hillco tapping machine, model 600, used to cut coupons from pipe.

Fig. 5. Insertion tool bolted to top side of gate valve, inserting plug of orifice assembly into nipple.

odorization control by collapsible orifice

specific rate of flow the day of installation at 300 psi, the orifice plate gave us a differential of 10 in. of water, which was approximately the differential we would have registered had an 8¼-in. standard plate been installed in a conventional orifice meter run.

Considerable economy was accomplished by using the Williamson collapsible plate rather than going to the cost of the conventional meter run. Further, certain penalties would have been incurred for interruption of service had it been necessary to blow down the line and cut it for the installation of a conventional orifice meter run. No disruption of service whatever was necessary by using this collapsible plate.

Based upon calculations of a standard orifice plate, with a known flow, the Williamson plate proved itself sufficiently accurate to create the desired differential required for running a Peerless odorizer or similar service.

Fig. 6. Williamson orifice plate collapsed for insertion.

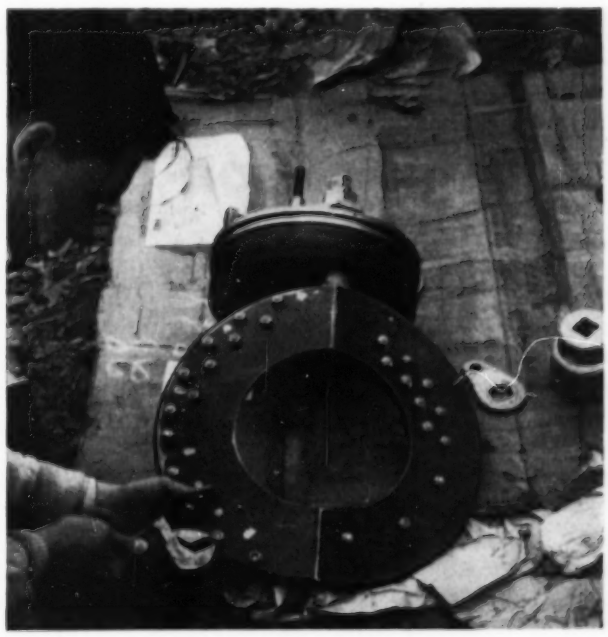


Fig. 7. Williamson orifice plate in open position.

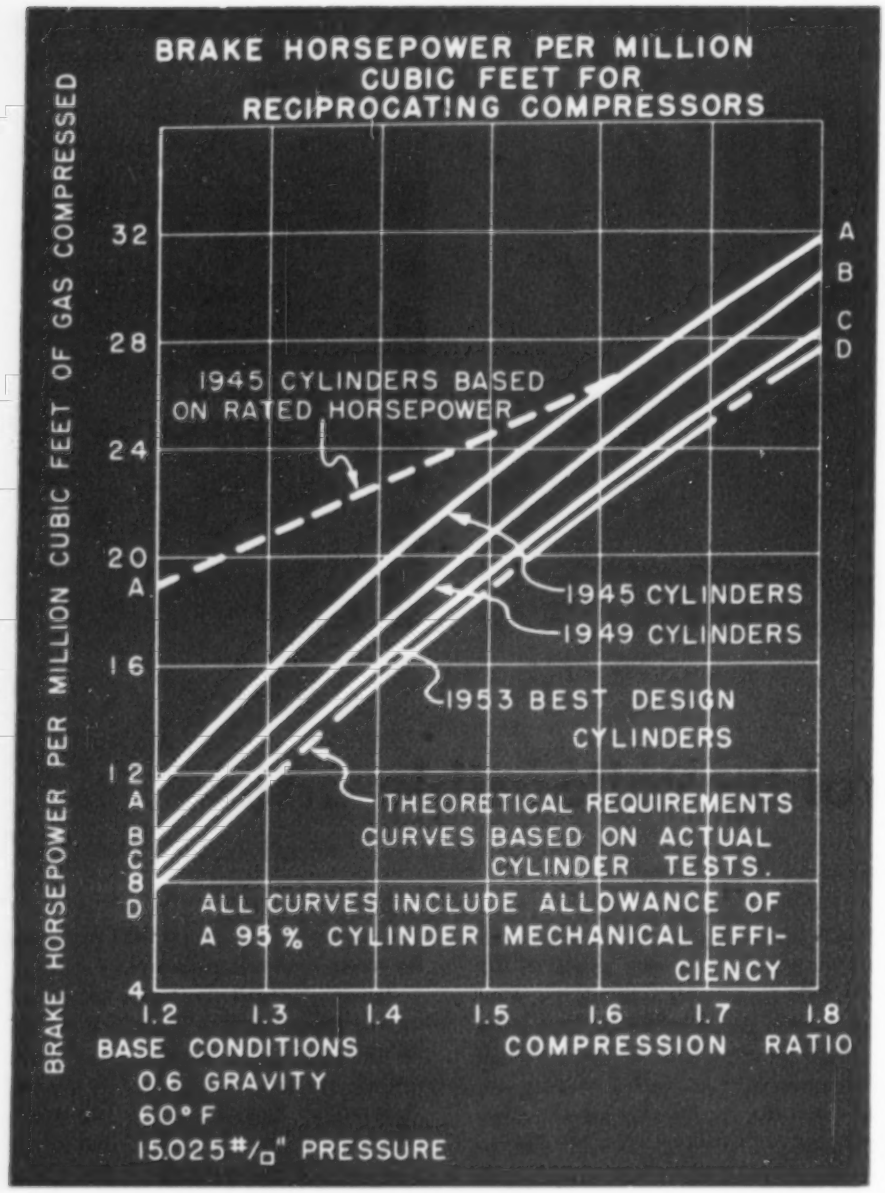


Fig. 1.

By B. T. MAST
Tennessee Gas Transmission Co.
Houston

A comparison of design and performance of modern compressor equipment

RECENT improvements in reciprocating engine compressors and the advent of new type prime movers for the compression of natural gas on natural gas pipelines have been introduced at such a rapid pace in the last few years that an appraisal of the present status of the various available units is quite in order.

To allow this appraisal to be more clearly understood, it is desirable to review the recent development of each of the various type units individually and then compare the present status of the equipment.

The reciprocating engine compressor

Reciprocating engines with reciprocating compressor cylinders mounted on the same frame have been the conventional gas compressing equipment for many years. By 1945, units available have been of the single and twin-tandem horizontal and the angle type. The angle type has been a unit with horizontal compressor cylinders and vertical power cylinders with both in-line and V-type construction. Engines were available of both 2- or 4-stroke cycle

design and enjoyed comparable performance.

Through the years, the horsepower requirements for design of pumping plants have been established empirically and recorded on a graph on which the brake horsepower per MMcf compressed is plotted relative to the compression ratio (ratio of discharge pressure to suction pressure) which the unit was to maintain. The curve in current usage in 1945-1946 may be seen as Curve A in *Fig. 1*.

Normal procedure

Normal procedure was to multiply the volume of gas to be compressed by the horsepower value obtained from this curve to establish the total amount of horsepower required to accomplish a given compression job. This curve, however, did not tell the full story and in inexperienced hands has led in some cases to difficulties. The difficulty was occasioned by the normal procedure of designing a pipeline system to assumed fixed operating conditions and selecting compressor cylinders to operate at the fixed ratio so obtained. In 1945 or 1946 this ratio was about 1.7 or 1.8. The ratio varies on the actual operating pipeline due to operations at load factors less than 100%, changes in volumes purchased or delivered through specific metering points and as a result produced an unloaded condition of the engine at ratios lower than the design point. If this unloading effect is taken account of by basing the curve on the rated horsepower of the engine, rather than actual developed horsepower, considerably greater installed horsepower will be required at ratios lower than the design point, as evidenced by the dotted portion of Curve A, *Fig. 1*.

It will also be noted upon comparison of Curve A, *Fig. 1* with the theoretical required horsepower to compress the gas (Curve D, *Fig. 1*) that a considerable portion of the developed energy was devoted to nonproductive work.

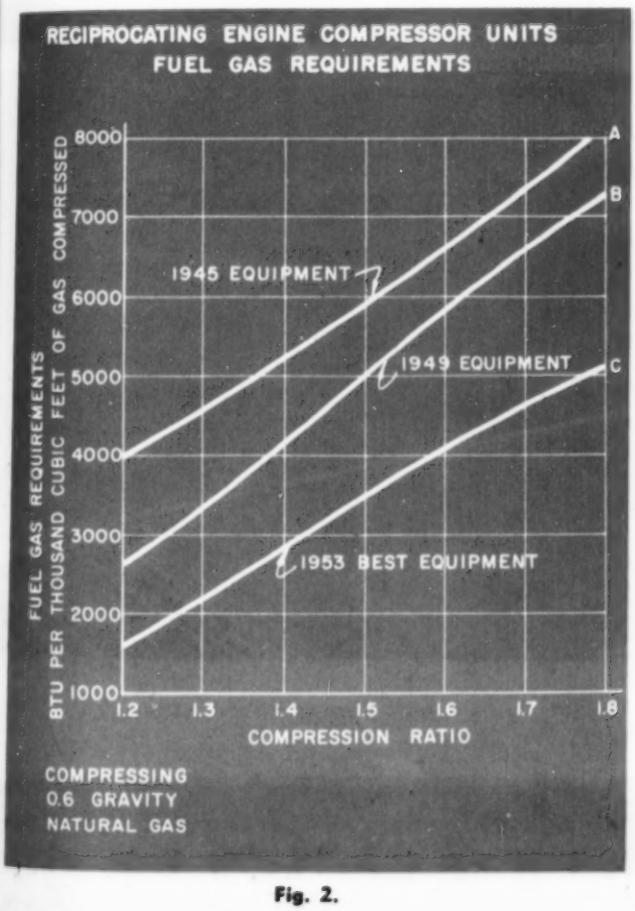


Fig. 2.

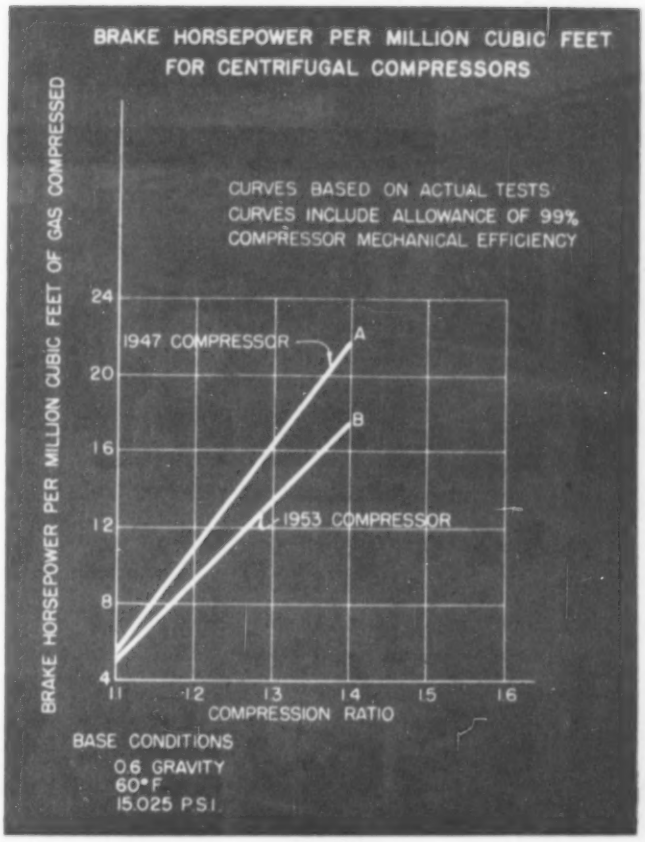


Fig. 3.

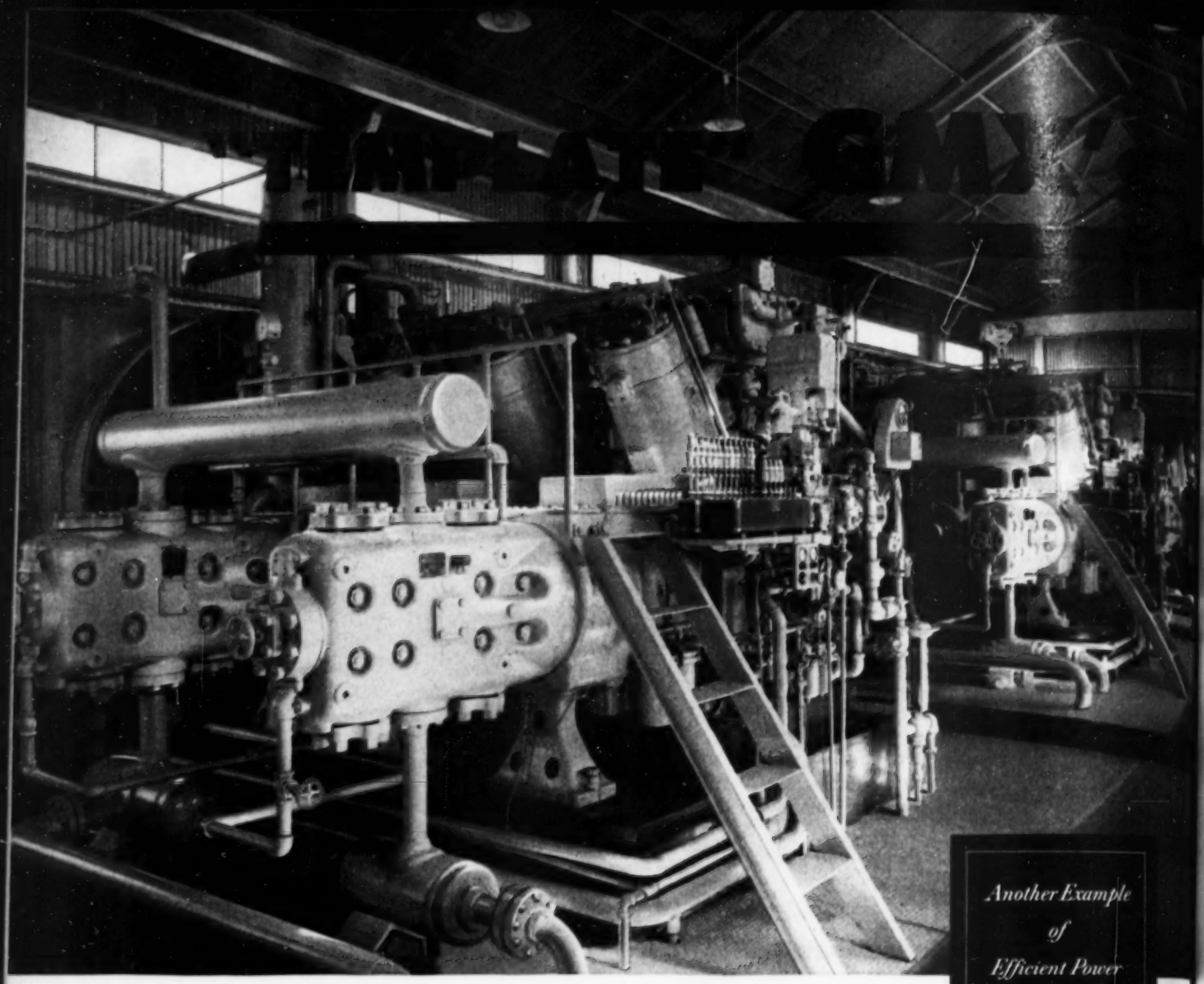
The brake horsepower-per-one-million curves compared to the theoretical required horsepower is a measure of the efficiency of the compressing unit only. The probable best measurement of the prime mover's efficiency can be assessed by the fuel consumption of the engine per brake horsepower of energy developed. To assess the full combined effect of the compressor and the prime mover, it is necessary to combine the efficiencies of both the engine and the compressor.

Comparing dissimilar units

Since the gas industry bases its thinking on the volume of gas handled, a comparison of fuel requirements, Btu's per day required to compress a thousand cubic feet of gas per day, can adequately serve as a tool to compare dissimilar units. The values of fuel required may be obtained by multiplying the fuel consumption in Btu's per brake horsepower hour by 24 hours by the brake horsepower required to pump a thousand cubic feet per horsepower hour. With 1000-Btu gas for fuel, the values will also be cubic feet of fuel per 1 MMcf of gas pumped.

About 1947, tests and studies were undertaken to achieve an improvement in compressor performance. These studies soon isolated the causes of the nonproductive work being expended, and indicated the type of cylinder design required to eliminate excessive losses and how to maintain full load on the engine throughout the desired range of compression ratios.*

*The design basis for this type of cylinder may be obtained from a paper originally presented by the author of this article at the Gas Short Course at Texas A & I College in Kingsville, Texas, in June 1949. This material was first published in the June 1950 issue of *The Petroleum Engineer* magazine in the Oil and Gas Pipelining Section, Page D-14. The title of the paper was "Compressor Cylinder Design for Gas Transmission Pipeline Systems."



Another Example of Efficient Power at Lower Cost

ANGLE

Compressors

New York Washington, D. C. Bradford, Pa.

San Francisco, Cal. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash.

PAY OFF 5 WAYS

in Shell's TXL gas lift system

THE compressors shown here are Cooper-Bessemer 330 hp GMX's in the Shell Oil Company operated TXL plant at Notrees, Texas. These units, with a capacity of about 7500 M.c.f. per day, supply the high pressure gas to 15 of the 23 wells being produced by gas lift. Here, residue gas from the nearby TXL gasoline plant is compressed from about 180 psi to 1100 psi. To maintain constant pressure with minimum manual control, the GMX's are equipped for automatic speed regulation and progressive automatic shutdown.

"Template" predesign is an important feature of these modern GMX's. Here are 5 ways it pays off:

1. Pre-engineering and pre-fabrication of all water, lube, fuel and compressor piping.
2. Greatly reduced installation time. (Can be compared to a skidded unit on permanent foundation.)
3. Elimination of costly steel skids.
4. No need to specify, order and expedite auxiliary equipment.
5. The V-angle GMX, simple and extremely compact, is ideally suited to template predesign and installation.

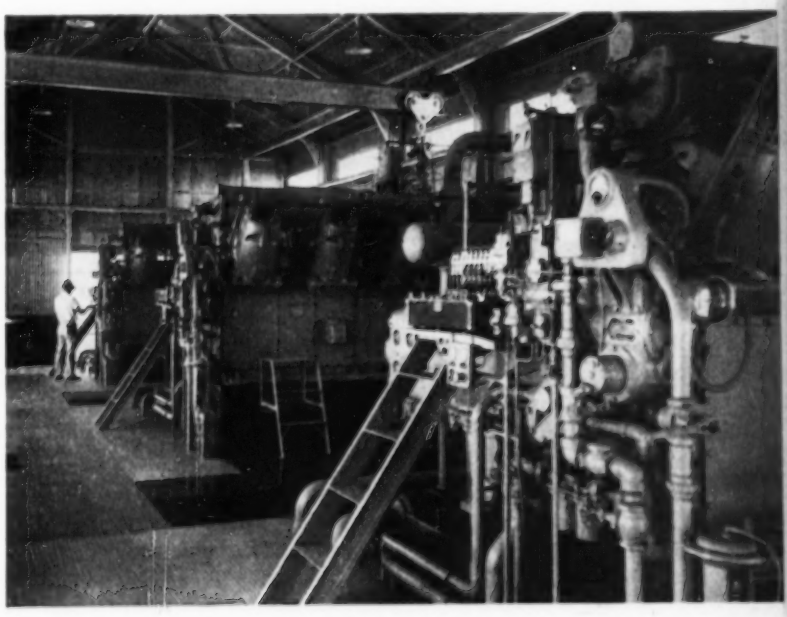
GMX compressors are built in sizes from 220 to 500 bhp.

Other Cooper-Bessemer V-angles, GMV's and GMW's, range up to 2500 bhp. Let the nearest Cooper-Bessemer office give you proof that these modern V-angles are easily your best bet.

TOP — This photo, from the compressor cylinder side, shows the 3 Cooper-Bessemer V-angles pre-engineered and fully equipped for complete "template" installation for gas lift service in the Shell Oil Company operated TXL plant, near Notrees, Texas.

LEFT — Gas lift compressor building housing the 3 "Template" GMX's. Capacity now totals about 7500 M.c.f. per day, with provision for expansion to 10,000 M.c.f.

RIGHT — The GMX's, shown here from the crank-door side, were furnished complete with all engine piping and auxiliary equipment, ready for fast, simple "template" installation on a concrete foundation.



by **Cooper-Bessemer**

MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

Tulsa Shreveport St. Louis Los Angeles Chicago

By 1949, engines were running with horsepower requirements in accordance with Curve B, *Fig. 1*, and by 1952 in accordance with Curve C, *Fig. 1*. As can be readily seen, these advances represent a major gain in increasing compressor efficiency and reducing the amount of horsepower required to perform a given compression job. The improvement as represented by the reduction of horsepower required for a given compression problem varies from 15% at a 1.6 compression ratio to about 41% of a 1.3 compression ratio.

Seeking greater economy

During the same period, engine manufacturers were engaged in improvements upon the engine to obtain greater fuel economy. In the period subsequent to 1946, the first major step was made in 1949 to reduce fuel consumption from about 10,500 Btu per horsepower hour to about 9500 Btu per horsepower hour primarily by raising combustion pressures in the power cylinders. The addition of a turbosupercharger for 4-cycle engines and an exhaust gas turbine driven blower for 2-cycle engines has generally led engine manufacturers by 1953 to guarantee a fuel consumption of 7500 Btu per horsepower hour. The combined effects of fuel consumption and the pumping ability of the compressors are presented by relating the fuel consumption to volume of gas compressed instead of the conventional reference to horsepower hours. Reference to *Fig. 2* will reveal the overall gains in efficiency of reciprocating equipment. The overall gain in efficiency of the equipment as measured by the reduction of fuel required for a given compression problem varies from 38% at a 1.6 compression ratio to 53% at a 1.3 compression ratio.

Several combustion gas turbines are presently installed and have been operating satisfactorily for some period of time on such services as power generation, marine power units, locomotive power units, and aircraft jet engines.

First combustion gas turbines

The first installation of the combustion gas turbines for pipeline service was made by the joint effort of Westinghouse, supplying the turbine, and Ingersoll-Rand, supplying the centrifugal gas compressor. The unit was installed on the Mississippi River Fuel Corp. pipeline at Wilmar, Ark., in May 1949.** This unit was a simple-cycle, 1850-hp, one-shaft machine with a fuel rate of approximately 16,000 Btu per horsepower hour. The compressor furnished with this unit is comparable in efficiency to the compressors being used today. The horsepower requirements of this type compressor may be seen as Curve B, *Fig. 3*. In order to assess the gas pumping ability of this unit, the fuel consumption per 1000 cu ft of gas compressed is Curve A, *Fig. 4*.

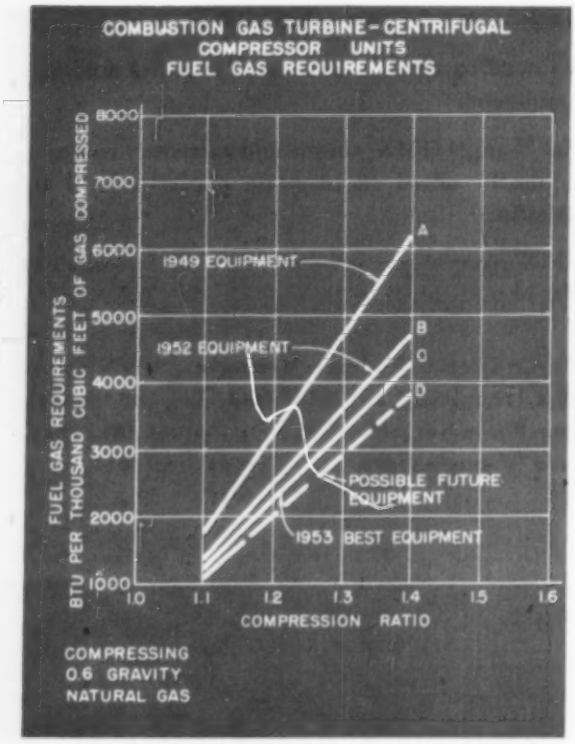


Fig. 4.

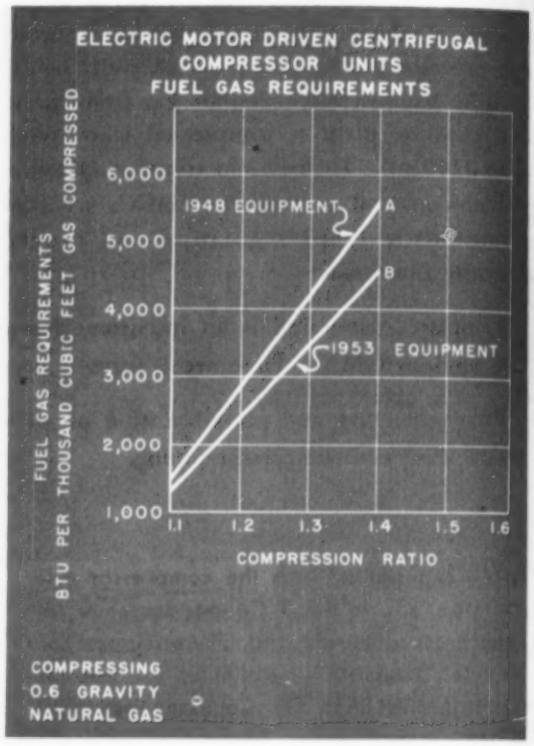


Fig. 5.

In spring of 1952 the first simple-cycle, 2-shaft regenerative turbine-driven compressor was installed on the Tennessee Gas Transmission Co.'s system in a joint venture with Clark Bros. This machine is of the type made by other manufacturers which are now installed on other pipeline systems and presently being offered for installation. The axial flow air compressor of this unit is a 10-stage compressor and the power unit is a 2-stage turbine with the two turbine wheels being mounted on separate shafts. The first shaft drives the air compressor and the second shaft drives the gas compressor. Fuel consumption of this unit is approximately 11,160 Btu per horsepower hour and the centrifugal compressor horsepower requirements conform to Curve B, *Fig. 3*. This

**See "Lower Unit Costs Achieved in Gas Turbine Pumping Tests" by J. O. Stephens, GAS, June 1952, page 94, and "Four Years' Operations With Turbine-Driven Centrifugal Compressors" by G. Carl Cooper Jr., GAS, September 1953, page 116.

● *Five miles west of Cushing, Okla., 10¾" Republic Electric Weld Line Pipe being laid.*

3 KINDS OF LINE PIPE ALL FROM REPUBLIC

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machine has an overall pumping efficiency in terms of fuel requirements per 1000 cu ft of gas compressed in accordance with Curve B, *Fig. 4*. Although compressor horsepower requirements for machines on other pipeline systems would closely approximate the Clark machine, fuel consumption figures on these units are not now available to assess their gas pumping ability in terms of fuel consumption.

High-volume, low-head machine

The type compressors discussed to this point are low-volume, high-head machines which will operate between 1.1 and a 1.32 compression ratio with a compression efficiency of 83%. Although no operating data are available at this moment, another type of compressor is available which is known as the high-volume, low-head machine for operation

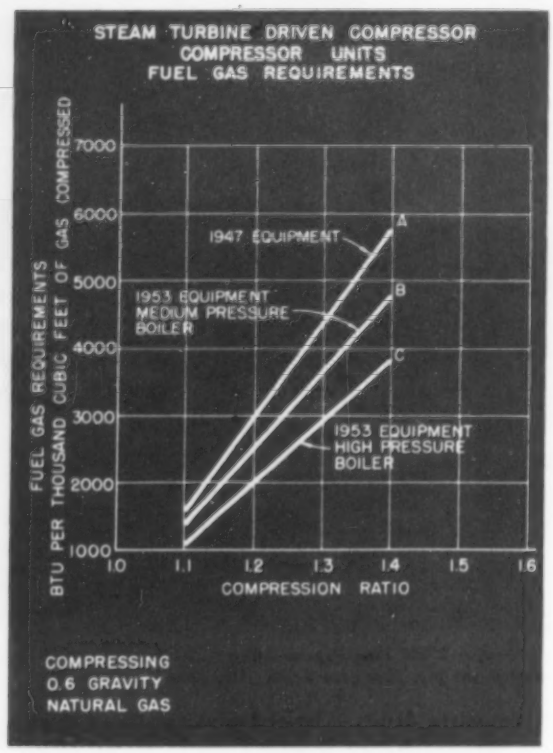


Fig. 6.

at compression ratios lower than 1.1 and with a reported 86% compression efficiency. These units would be used in series operation nearly exclusively. The increase of 3% in compression efficiency would lead to an overall more efficient plant.

Recent improvements

Improvements in the turbines within the last year have led the manufacturers to offer for installation units with a fuel consumption rate of 10,280 Btu per horsepower hour. This fuel rate, combined with present compressor performance, would indicate an overall fuel economy indicated by Curve C, *Fig. 4*.

Further improvements in efficiency of the turbine unit are nearly directly dependent on the ability of the turbine blading to withstand temperature. Present units are being rated on blade temperature of 1400° F to 1450° F. An increase of turbine blading temperature of 100° F would indicate the fuel consumption rate could be dropped to 9500 Btu per horsepower hour. An additional 100° elevation in blading temperature would yield a corresponding decrease. With the present production and research being carried out on gas turbines and aircraft jet engines, it would appear that increased blading temperatures will be obtainable in the near future.

A 200° increase in blading temperature should yield a fuel rate of 9000 Btu per horsepower hour which, combined with the present gas compressor efficiencies, would yield a fuel consumption curve per 100 cu ft of gas compressed as indicated by Curve D, *Fig. 4*.

More complicated types

Although turbines can be built employing more complicated systems such as multi-staging of the air compressor with intercooling and reheating to obtain higher efficiencies, these systems appear to be too costly and complex from an operating standpoint to be used for pipeline service; therefore, these type units have not been considered in this analysis.

Electric motor-driven compressors

Electric motors driving centrifugal compressors for natural gas pipelines were probably first employed to an appreciable extent in the conversion of the War Emergency Big and Little Big Inch pipelines which were converted from oil to gas service in 1947.

This conversion also marked the first extensive installation of centrifugal compressors for gas pipeline service. The horsepower requirements of these initial compressors were as indicated by Curve A, *Fig. 3*.

Comparison basis

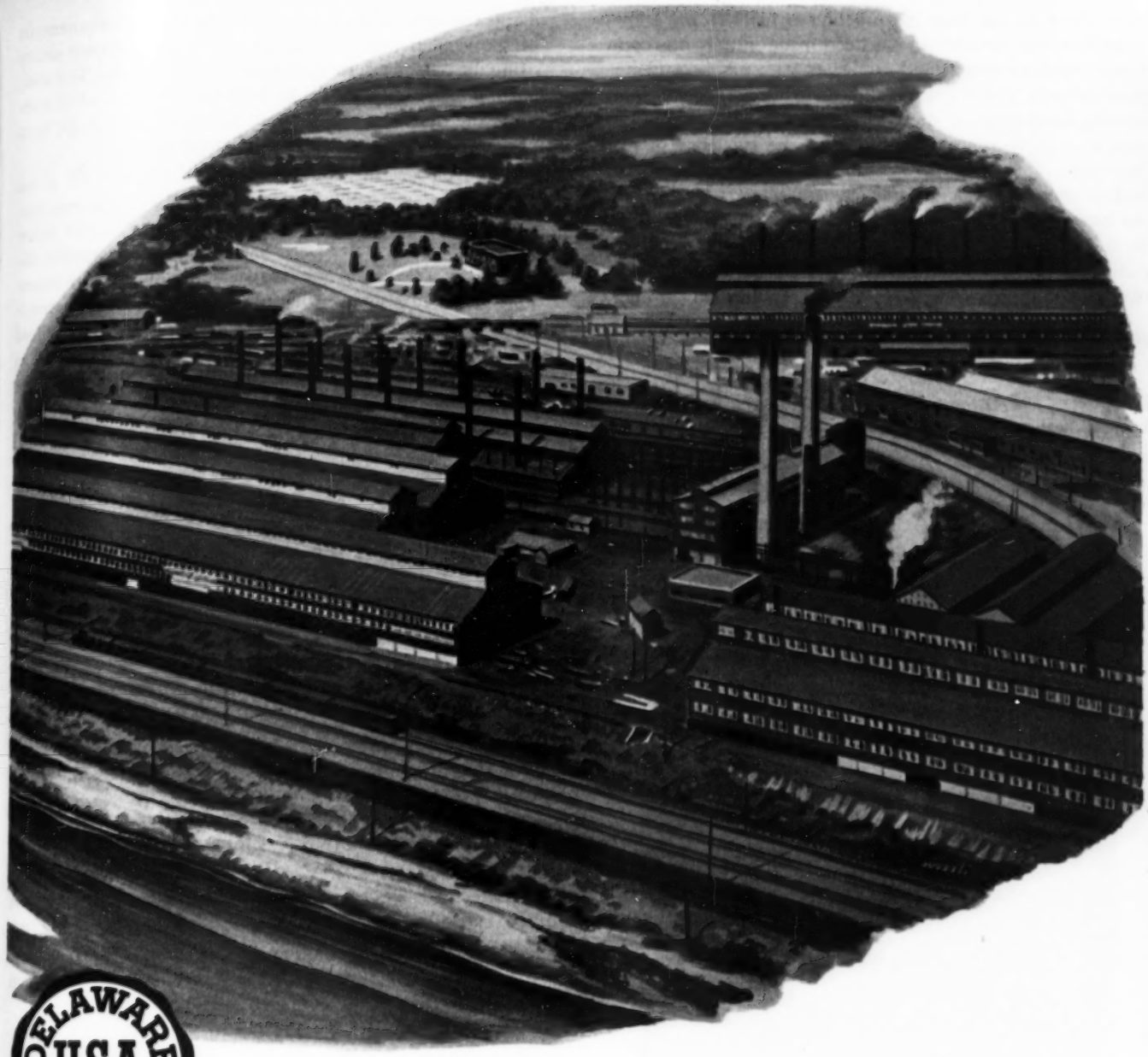
In order at this time to eliminate the differences of opinion as to the method of comparing natural gas fuel costs to electric pumping power rates, the efficiency of this type installation can be compared to other equipment by assuming the gas company will generate its own power from fuel taken from the line and using generating plant efficiencies and electric transmission line efficiencies obtainable in the period of time with which we are concerned.

Electric generating plants with medium pressure boilers and turbines combined with generator, transmission line, and motor losses would indicate a fuel consumption rate in 1948 of about 10,830 Btu per horsepower hour. This fuel rate, combined with horsepower requirements of the compressors available in this same period, would indicate a fuel consumption rate as indicated by Curve A, *Fig. 5*, based on Btu's per 1000 cu ft of gas compressed.

Using the same type electric installation and the most efficient centrifugal gas compressors available today, the fuel consumption rate would be about 10,830 Btu per horsepower hour and an overall rate in Btu per 1000 cu ft compressed as indicated by Curve B, *Fig. 5*. This curve would probably represent the average fuel consumption rate if power were purchased today in most parts of the country.

Steam turbine-driven centrifugal compressors

The remaining new type of compressor equipment which is currently being used is a steam turbine-driven centrifugal compressor unit with steam being generated in boilers at the



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plant site with gas from the pipeline as fuel. To my knowledge this type installation has been made in only one company's pipeline system and published data on these plants' performances is not yet complete. However, general engineering knowledge of the performance of components can lead to a fairly accurate appraisal of the efficiency of this type drive. These plants are equipped with medium pressure boilers, the most modern and efficient steam turbines, and the most efficient centrifugal gas compressors available today. By the combination of published efficiencies of the various components, these installations should yield a fuel consumption rate of approximately 11,260 Btu per horsepower hour.

Rate of consumption

This fuel consumption rate, if combined with centrifugal compressor horsepower requirements of 1947, would have had an overall fuel consumption rate as indicated by Curve

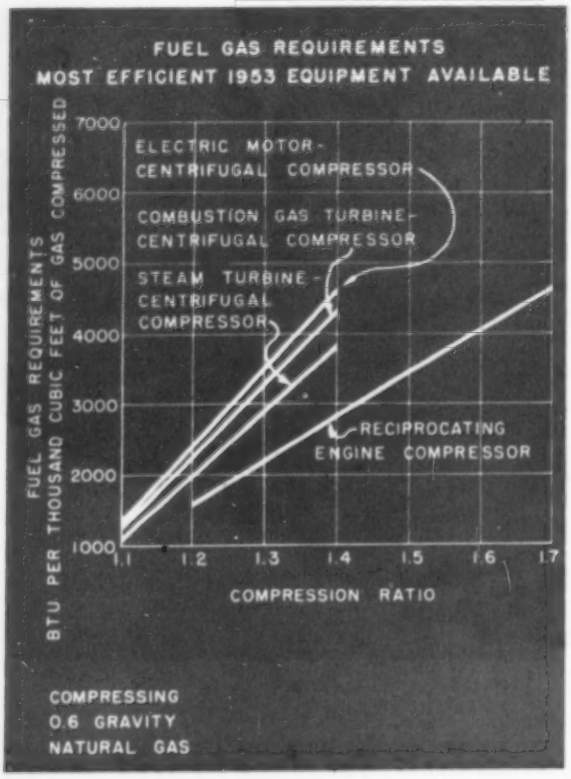

Fig. 7.

A, *Fig. 6*, if such a plant had been built in 1947. By the time the first plants of this nature were constructed however, improved compressors had been designed as represented by Curve B, *Fig. 3*. The fuel consumption rate of 11,260 Btu per horsepower hour, combined with the centrifugal compressor horsepower requirements indicated by Curve B, *Fig. 3*, should yield an overall plant fuel consumption rate as indicated by Curve B, *Fig. 6*.

Similar plants using high pressure, high temperature boilers should yield a fuel consumption rate of about 9000 Btu per horsepower hour and an overall plant fuel consumption rate as indicated by Curve C, *Fig. 6*.

Comparison

A comparison of the various types of driving units available for use on an efficiency basis giving the effect to the overall efficiency of the prime mover and the compressor as a unit can now be made by comparing the fuel requirements of the various units in relation to its gas pumping ability using the most modern equipment available today. This comparison can readily be seen by reference to *Fig. 7*, which combines the best possible fuel rate curves of each of the types of drivers with their companion compressors.

The reciprocating compressor curve marked "D" is not extended below a compression ratio of 1.2 for several reasons. Reciprocating compressors operating at ratios below this point would require such large compressor cylinder displacement to load the engine that it becomes nearly impossible to provide sufficient clearance to unload the engine at ratios appreciably above a 1.2. Cylinders that adequately load the engine from a 1.2 to a 2.0 compression ratio fall off so severely in loading the engine below a 1.2 that it is not practicable to apply this equipment to services with fluctuating ratios in this region.

Higher fuel requirements

The three other type units require considerably higher fuel with ratios above 1.2. Even though these three units have considerably poorer fuel economy, they may well have useful application due to the other component operating costs of a pipeline system. No attempts will be made in this article to assess the other operating costs to establish the most economical unit in a given situation because of the wide variance in operating and maintenance costs experienced in the various sections of the country by the different pipeline operators.

Certainly the possibility of a decreased labor cost, because of different manpower requirements of the various units, can possibly offset or overbalance the fuel disadvantage. This point, however, must be assessed by the individual designer using the operating costs that he has experienced.

Some new proposals for other type compressing units have been advanced within the last year and may be of interest:

A reciprocating gas engine with a very low fuel consumption driving a centrifugal compressor through gear trains has been proposed by two manufacturers.

A combination combustion gas turbine and steam turbine plant driving centrifugal compressors has been proposed. The main feature of this installation is to use the turbine exhaust gas heat for feed water heating of the steam plant to obtain an overall more efficient plant.

Another combination combustion gas turbine and steam turbine plant has been proposed featuring a combustion gas turbine as the primary unit and a secondary low-pressure steam turbine unit using waste heat boilers in the gas turbine exhaust to generate 150-lb steam.

Free piston engine

Another unit for possible application to pipelines consists of a free-piston engine serving as a hot-gas generator supplying a hot exhaust gas stream to a turbine which would drive a centrifugal gas compressor.

The tremendous increases in efficiencies obtained in compressing equipment since 1945 have completely upset previous balances between pipeline and compressor station operating costs.

A reappraisal of pipeline system designs based upon improvements in compressing equipment may lead to interesting possibilities for increased efficiencies in existing pipeline systems.

more power!

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Delivering substantially more power than any compressors of comparable displacement, the *new* Clark 2-Cycle Turbocharged Gas-Engine-Driven Compressors are the most important development in the industry today.

Boasting a 50% power increase over non-turbocharged units of comparable size, the Model TRA delivers 825 to 1650 bhp per unit. This tremendous increase in output is accomplished with no sacrifice of overload capacity or in the ruggedness and durability characteristic of *all* Clark Compressors. *Actually, for their horsepower, Clark Turbocharged Compressors are the most rugged ever built.* The conservative BMEP rating of 92, together with the massive construction of the Model TRA, bear this out.

Where units of even greater output are required, Clark offers the world's most powerful gas-engine-driven compressor—the Turbocharged Model TLA—rated at 2000 to 3300 bhp per unit. Compared to non-turbocharged compressors of the same displacement, the TLA produces 36% more power at the conservative BMEP rating of 101.

While power output is vitally important in compressor design, economy of operation is even more important. Clark Turbocharged Compressors burn 12½% less fuel and require slightly over half of the cooling water used by non-turbocharged units. From these and other unique advantages, it is not hard to visualize the important savings in installation and operation of Clark Turbocharged Compressors.

For complete details, call your nearest Clark representative or write for Bulletin 130.

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Efficacy of dry chemical equipment graphed in transmission line fire tests

WHAT type of equipment is best suited to fight gas fires and in what quantities is it needed for any given set of conditions?

Both Texas Eastern Transmission Co. and Ansul Chemical Co. were interested in finding an answer to these questions. They found their solutions in data collected from a series of fire tests on Texas Eastern properties near Longview, Texas.

The three specific problems posed were:

1. How suitable is dry chemical fire extinguishing equipment on typical natural gas fires?
2. What size and type of equipment is proper for use at compressor stations?
3. What are the limiting volumes and conditions under which burning gas can be extinguished by various size dry chemical units?

Test setup

The appointed site, a 24-in. gas transmission line, carries large volumes of gas at a pressure of about 850 psi. From this line, approximately 500 ft of 6-in. pipe was laid to an open test site. The end of this pipe was anchored to a large block of concrete for safety. A meter run was provided in the 6-in. pipe where the flow of gas could be measured accurately. Fittings were provided so that the gas could be discharged vertically or horizontally and so that the 6-in. line could be reduced to ½-, 1-, 1½-, 2-, or 4-in. pipe. A tap was provided near the end of the 6-in. pipe so that the pressure at this point could be recorded.

For the test, 4-lb, 20-lb, and 30-lb hand extinguishers, 150-lb and 300-lb wheeled extinguishers, and 500-lb, 1000-lb, and 2000-lb stationary extinguishers were furnished, together with hose, nozzles, adapters, carbon dioxide cartridges for the hand extinguishers, nitrogen cylinders for the large extinguishers, and a large supply of dry chemical.

The hand and wheeled extinguishers used in the tests had the following average flow rates:

Extinguisher Model	Dry Chemical Flow Rate Lb Per Sec
20-B	2.0
30-B	2.0
150-B	2.5
350-A	3.0

The Ansul Models 500-A, 1000-A, and 2000-B stationary extinguishers will supply one, two, and four 1-in. hose lines, respectively. Each of these 1-in. hose lines has a flow rate of 7.5 lb of dry chemical per second.

In addition to evaluating the extinguishing equipment, part of the test program was to determine which types and sizes of fires could be attacked wearing normal work clothing and which required special protective equipment.

The tests were set up to duplicate as closely as possible conditions that might be encountered in actual practice. These included the following:

1. Vertical jet with 6 ft stack on outlet.
2. Low level vertical jet.
3. Horizontal jet.
4. Horizontal jet impinging against earthen bank.
5. Horizontal jet impinging against steel plate.
6. Downward impingement.
7. Pit fire with gas discharging from slit in bottom of pipe.

A general conclusion may be drawn from the test results: the dry chemical fire equipment that was used is suitable for natural gas fires involving pressures up to 850 psi. Such fires may be at producing wells, in transmission lines, or at gas utility plants.

It was anticipated before the tests that the impinging type fires would be more difficult to extinguish than the freely discharging or jet type fires. The test results confirm this and indicate the need for more and/or larger equipment to extinguish impinging fires.

Data reviewed

The data for all of the tests were carefully reviewed and analyzed and it was found that they could be reduced to graphic form to express the relationship between the rate of flow of the natural gas and the rate of flow of dry chemical required to extinguish the fire. *Fig. 1* shows this relationship for

SCOPE OF TESTS

(1) A total of 191 tests were conducted over eight working days.

(2) 930,563 cu ft of gas were discharged.

(3) The maximum rate of gas flow for one test was 2610 cu ft per second (equivalent to 225,504,000 cu ft per day).

(4) 47,000 lb of dry chemical were used during the tests.

(5) 57,640 cu ft of nitrogen were used to expel the dry chemical.

(7) Sixteen engineers and technicians from the gas pipeline company and eight from the chemical company took part in the tests.

stop vibration before it starts

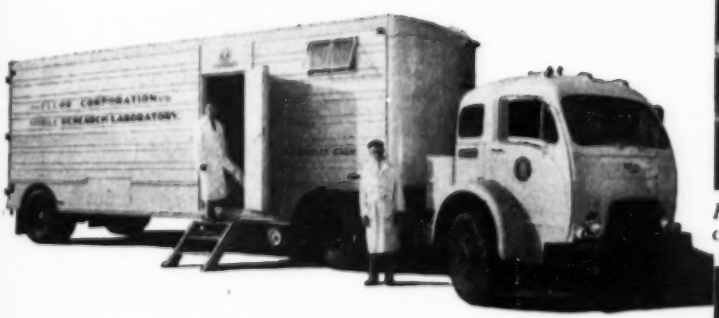
with a FLUOR pulsation dampening piping system

A Fluor Pulsation Dampening Piping System smooths out the "puffs" created by reciprocating action of compressors. It eliminates one of the chief causes of piping vibrations. A smooth, steady gas flow incurs less frictional resistance and reduces line breakage due to pipe fatigue. Without dampeners there is no alternate solution: *no matter how well pipe is anchored, the basic pulsations remain* – to cause problems with metering accuracy and plant safety.

For new construction, Fluor supplies the complete piping system, prefabricated, ready for installation. Pulsation dampening is designed right into the basic compressor system through an engineered selection of bottles, headers and laterals. *It is built in, not added on.* And it costs little more than a conventional system because it eliminates expensive pipe anchoring and allows the design of related equipment based on a system free of pulsative flow.

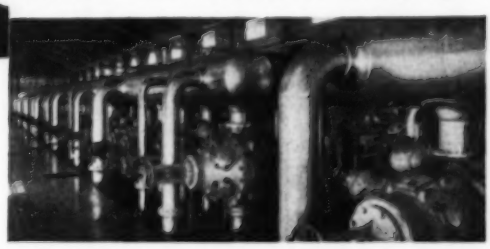
For existing construction, Fluor's two "package-type" Pulsation Dampeners, in both manifold and in-line types, are easily installed in existing plants with an excessive vibration problem. The Fundamental Dampener minimizes objectionable pulsations while providing the continuous advantages of low pressure drop and less stress on piping, heat exchangers and vessels. The High Frequency Dampeners are supplied where pulse frequencies are in the range of the second harmonic or higher.

Fluor Pulsation Dampening Piping System built into new compressor station assures accurate metering.



Fluor's Mobile Research Laboratory

Manned by capable engineers experienced in the phenomena of sound and vibration, Fluor's Mobile Research Lab is fully equipped to conduct on-the-spot tests to determine the source, extent and best means of eradicating plant piping vibration.



Fluor Pulsation Dampeners curb vibration caused by reciprocating action of compressors.

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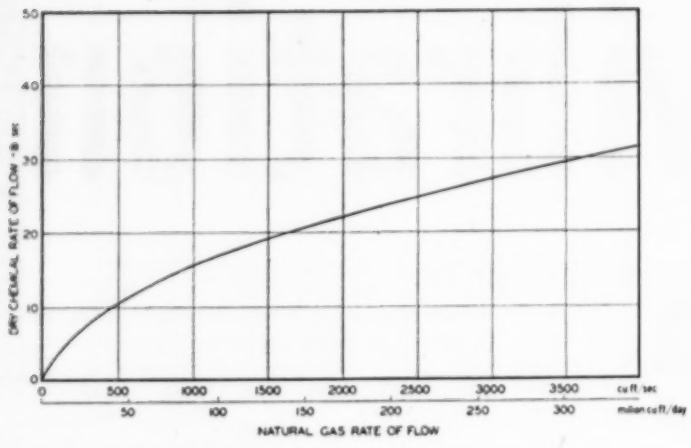


Fig. 1. Rate of dry chemical flow required to extinguish non-impinging type natural gas fires.

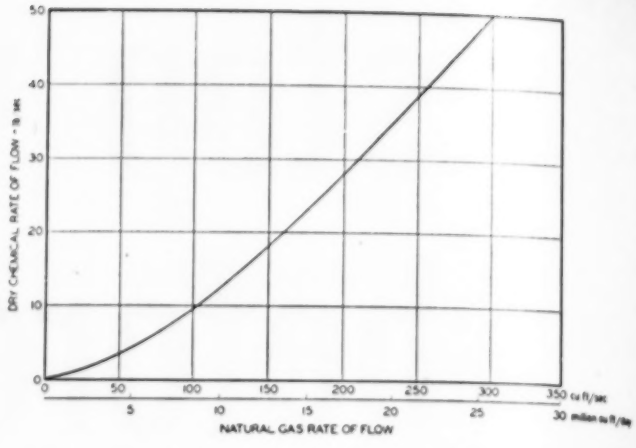


Fig. 2. Rate of dry chemical flow needed to extinguish impinging type natural gas fires.

the freely discharging non-impinging type fires and *Fig. 2* shows the ratio of impinging type fires.

Selection of proper equipment

The flow rate figures shown on the charts *(Figs. 1 and 2)* permit the selection of the proper equipment for extinguishing fires involving various gas flows. It should be noted that the charts are based on the 1000 Btu gas used in the tests. Based on data from other tests by the chemical company, it can be reasonably assumed that the difficulty of extinguishment and amount of equipment needed will decrease or increase with flammable gases having a heat content below or above this figure. Known exceptions, however, are hydrogen or carbon monoxide which require special consideration.

An example of the use of one of the charts is as follows:

1000 Btu gas is escaping from a vertical jet at a rate of 750 cu ft per sec (approximately 66 MMcf per day). A vertical line is drawn from 750 on the horizontal axis of *Fig. 1* to the curve. A horizontal line is then drawn from the point of intersection to the vertical axis where the dry chemical flow required for extinguishment is found to be 13.5 lb per sec. Five Model 350-A wheeled extinguishers or two 1-in. lines from stationary extinguishers will provide the necessary rate of dry chemical flow.

Impinging type fires

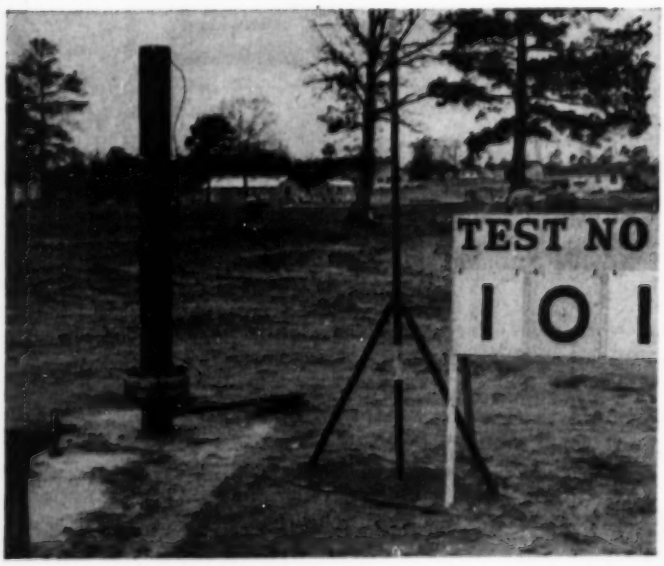
Fig. 2 is used in the same way except that it shows the requirements of impinging type fires.

The foregoing charts and calculations are based on the equipment being used by trained, but not expert personnel.

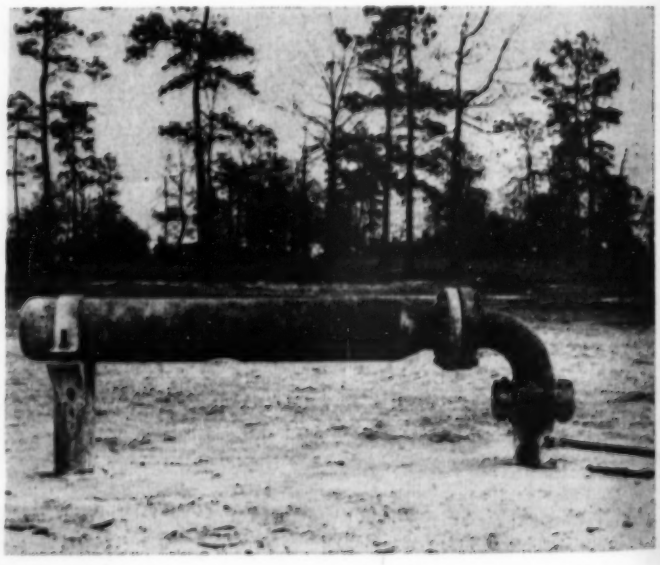
With the protection afforded by the dry chemical stream the various types of non-impinging fires can be approached by fire fighters wearing ordinary work clothing. Wool clothing is recommended because it offers greater resistance to ignition than does cotton.

Protective clothing

Where large impinging type fires are anticipated protective clothing should be available. The equipment used by fire fighters in these tests consisted of bunker coats and safety helmets with ⅛-in. thick Plexiglass face shields. This protection permits close approach to very severe fires without danger to the men.



Setup for 6-in. vertical jet fires with 6-ft long stack in place. Marked pipe was used to measure flame heights in photograph.



Setup for 4-in. impinging jet fires. Flames struck a steel plate placed 30 ft away.

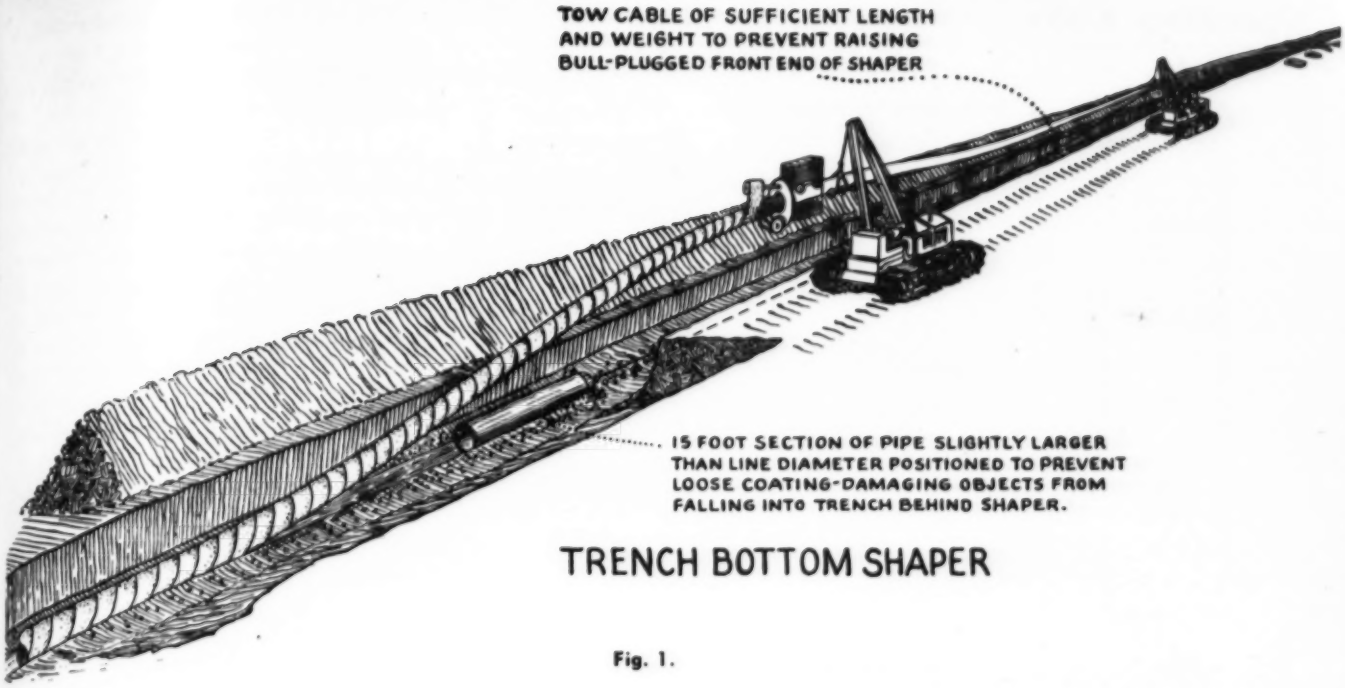

TOW CABLE OF SUFFICIENT LENGTH AND WEIGHT TO PREVENT RAISING BULL-PLUGGED FRONT END OF SHAPER
15 FOOT SECTION OF PIPE SLIGHTLY LARGER THAN LINE DIAMETER POSITIONED TO PREVENT LOOSE COATING-DAMAGING OBJECTS FROM FALLING INTO TRENCH BEHIND SHAPER.
TRENCH BOTTOM SHAPER

Fig. 1.

Protecting wrapped pipe from installation damage

By O. C. MUDD • Shell Pipe Line Corp., Houston

APPLIED coating contributes an appreciable part to new line construction costs and serves primarily in protecting the larger investment in pipe plus assuring better operating continuity. It appears only reasonable to prevent avoidable coating damage when such preventive measures add only a fraction of the coating cost.

If cathodic protection is applied, this additional cost in preventing coating damage reduces the number of installations required, lowers the cost of electrical power and minimizes soil potential gradients that would adversely affect other structures and necessitate current drainage bonds.

Coating damage during the lowering-in operation can be minimized by relatively simple methods. It is essential to maintain full trench width free of side-wall projections and to clear debris from the trench bottom that may cause coating damage. Portable guard boards of plywood placed along jagged trench walls during lowering-in help to avoid damage. Long handle garden rakes in the hands of properly instructed workers have been effective in removing potential damage objects from the trench bottom during lowering operations.

A 15-ft section of pipe, slightly larger in diameter than the coated pipe to be laid, pulled along the trench bottom just prior to lowering the pipe will help reduce bottom side coating damage. This "trench bottom shaper" or "mole" serves to round out the trench bottom (thus increasing the coated pipe support area), pushes hard objects or rotating sharp edges away, and moves excess dirt from high points to low ones thereby eliminating many pressure points or areas against the coating that would exist. This procedure is illustrated in *Fig. 1*.

Pipe lowered into the trench with coating intact may then be damaged during backfill operations. The impact of heavy solid materials such as rock, clods or debris in the backfill falling against the pipe can cause fracture of brittle coatings or penetrate and scar soft or pliable types.

More damage may occur as the backfill settles. Hard objects already in contact or near the coating are carried downward against the top pipe surface or wedge against the side during settlement causing coating displacement. This action may be slow, depending on soil types and its moisture content. Consolidation of the backfill may be

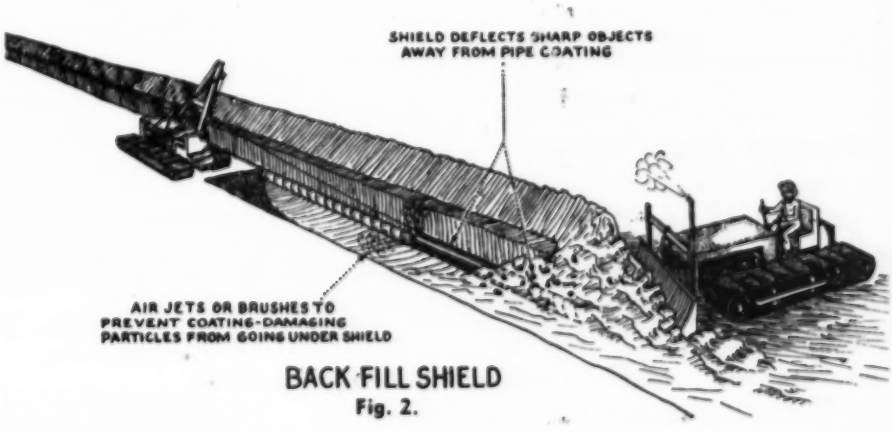
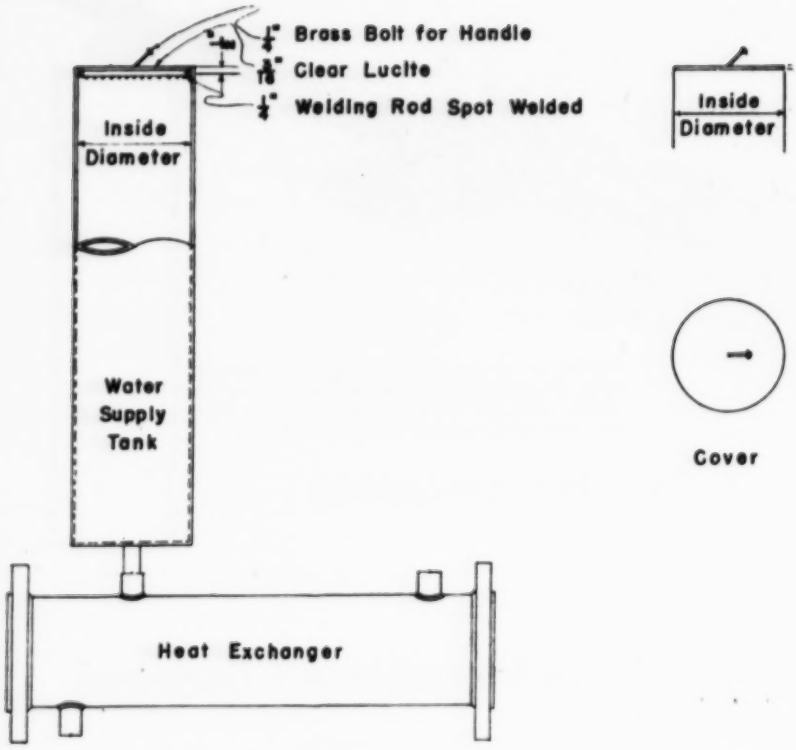

SHIELD DEFLECTS SHARP OBJECTS AWAY FROM PIPE COATING
AIR JETS OR BRUSHES TO PREVENT COATING-DAMAGING PARTICLES FROM GOING UNDER SHIELD
BACK FILL SHIELD

Fig. 2.

This article was adapted form a paper presented at the Annual Meeting of the American Petroleum Institute in Chicago, November 1953.

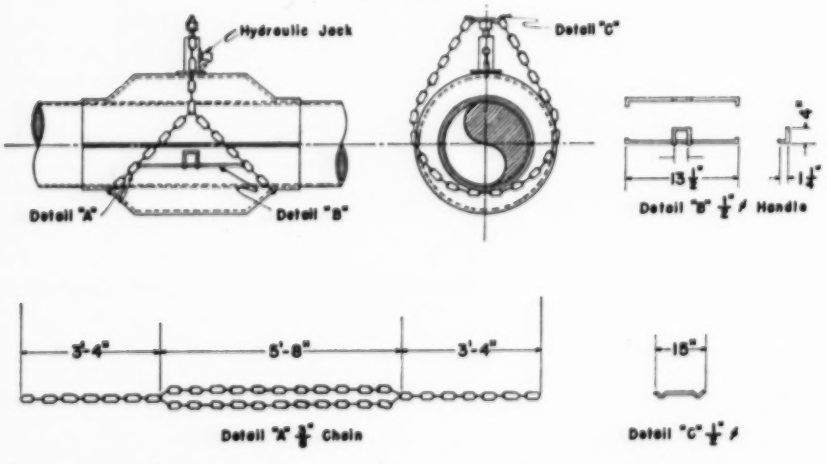
Operating kinks



Water supply tank cover

A lucite water supply tank cover for line heaters, which has the dual advantages of allowing visual inspection of the water level and acting as a safety relief valve in the event the heating system becomes steam locked and builds up pressure, has been invented by Harold K. Ford, district superintendent at Zionsville station of Panhandle Eastern Pipe Line Co.

Other advantages claimed for the cover are ease of tank filling and impressive savings in time and material. The old-style cover which this model replaces consisted of a welded plate with a 2-in. coupling welded into the plate, and a 2-in. bull plug with a small diameter hole drilled for a vent.



Pipeline sleeve sling

A pipeline sleeve sling invented by Glenarm (Kan.) division welder Kenneth J. Bryan is saving time, labor, pinched fingers, and lifting strains for pipeliners of Panhandle Eastern Pipe Line Co.

The sling gives proper balance to the sleeve when it is lifted into position by creating tension at the welding points instead of only at the center of the sleeve.

Made up of two 5-ft 8-in. lengths of chain, joined at the ends to two 3-ft, 4-in. lengths of chain, the sling replaces the conventional single chain that was being used in the operation. A handle is hooked on the chain to facilitate lifting.

Both items courtesy Panhandle Lines.

complete within a few months where rainfall is frequent and a high soil moisture content prevails while that in arid sections may take several years.

Where there is enough fine material included in the excavation, damage by impact during backfill and much of that occurring afterward during settlement can be minimized by towing a metal shield or "lizard" along the top of the coated pipe while the backfill is progressing. This moving shield should cover the upper half of the coated pipe and provisions should be made to prevent rock particles or similar objects from going under the shield as it is moved. Not only does this shield protect the coating from impact, but the movement along the pipe also assists in sifting the finer particles down along side the pipe and diverts or rolls sharp edges of rock away from the shield surface. The use of such a shield is illustrated in *Fig. 2*.

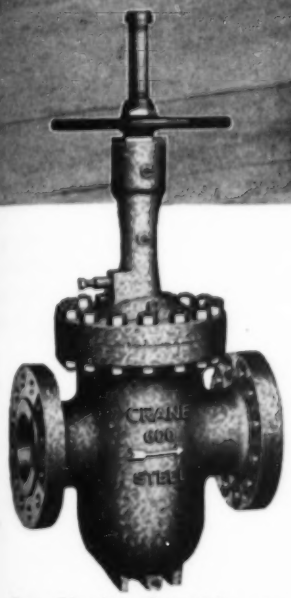
After backfill consolidation, coating damage can also occur from soils that shrink or expand with change in moisture content. This type of damage continues as long as the pipe remains in place hence it is important to coatings with good resistance to such action.

Trenching through rock and backfilling with the excavated material is one of the most perplexing problems in preserving good coating. Padding the rock trench bottom and making the initial backfill with fine loose material such as top soil to give near uniform support and coverage of the coated pipe is a frequent practice.

Divert surface drainage

Such soil padding has been washed from rocky trenches by heavy rains after backfilling and severe coating damage has resulted; hence it is advisable to take precautions in diverting surface drainage away from such trenches. Whenever the pressure against most currently used coatings exceeds 10 psi severe damage will occur within a few weeks. The occasional practice of supporting coated pipe on loaded sacks or soil mounds at intervals results in coating impairment at the support points.

Crushing rock for padding has been tried with promising results; however, manufacturers must design more suitable equipment. Calculated costs on a trial, including operation, maintenance and depreciation, indicated less than $0.30 per cu yd to crush stratified lime rock to a size suitable for use in the trench bottom and initial backfill.



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And to assure smooth, clear flow with minimum pressure drop, Crane designed the conduit-type disc ports to coincide exactly with the seat openings. There are no pockets to catch dirt or cause turbulence. Read all about this pipe line favorite in your Crane 53 Catalog and in Circular AD-1864 available from your Crane representative, or write direct.

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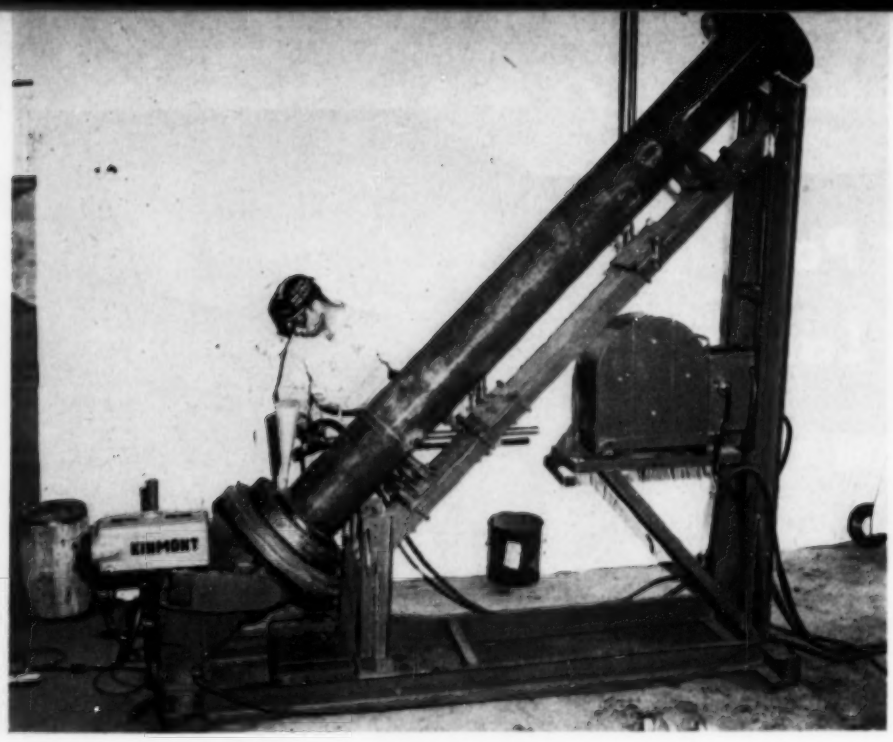


Welder Al Snyder demonstrates the new turning and positioning jig which was recently developed by the staff of Northern Natural Gas Co.'s South Omaha meter shop. The mechanism at the lower left turns the pipe automatically while the welding arc is held in a stationary position.

Northern's fabrication jig doubles meter run production

A RECENTLY developed turning and positioning jig has doubled the meter run production capacity of the South Omaha meter shop of Northern Natural Gas Co. According to Anton Steinbacher, superintendent of the shop, a welder and helper are able to turn out complete 4-in. meter runs at the rate of four per day by using the jig, which was developed under his direction by the meter shop staff. Before the development of the jig, the same number of men were able to turn out only two 4-in. meter runs in a day's time.

Capabilities of jig

The jig consists of an automatic concealed arc welding machine, a hopper with a hose connection which feeds the flux around the weld, and the positioner for rotating the pipe automatically. The jig is capable of welding flanges on the inside and also on the outside of pipe from 4 to 10 in. in diameter. Although the flanges must still be lined up and tacked by hand-welding before the meter run is placed on the jig, the actual welding can be done in two minutes, an operation which formerly took approximately 75 minutes by hand-welding.

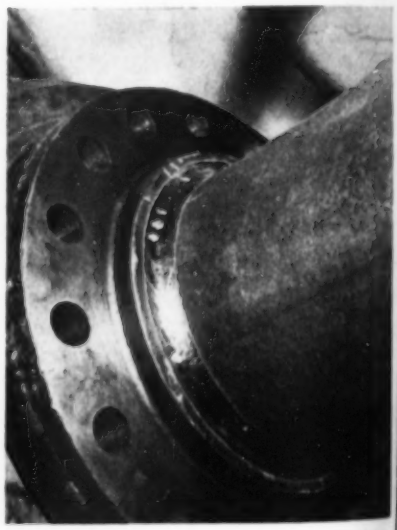
Mr. Steinbacher got the idea for the jig when he visited a steel fabricating plant and saw a jig for welding flat surfaced metal in a horizontal position. Because meter runs must be welded on the round, a jig incorporating many of the same principles, but completely different in design, was developed.

Such things as the proper heat, amperage and voltage were necessarily taken into consideration. The positioner had to be developed so that the pipe would be rotated at the correct speed in inches of weld per minute for proper penetration into the metal, and the problem of lapping over as each cycle was completed had to be solved. Another problem was keeping the hot metal from running off the pipe during the welding process and this was solved by constructing the jig in such a way that the pipe tilts at a 45° angle.

Still in experimental stage

Mr. Steinbacher says that the jig is still in the developmental stage and improvements are constantly being made. Through the use of the jig, stronger, smoother welds are obtained, and it is expected that future improvements will cut down production time even farther.

A close-up view of welding on the jig in progress shows the funnel-like hopper for holding the flux. The wire which forms the arc leads down inside the hopper from the hose connection.



This finished weld backs up superintendent of the meter shop, Anton Steinbacher's claim of a smoother weld.

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"The 335 miles of 6⅝ inch OD pipe line extends from Topeka, Kansas, to Sioux Falls, South Dakota. A lightweight pipe of 14.96 pounds per foot was used in this construction because the line was to be coated in its entirety and in addition maintained under cathodic protection. This weight of pipe was selected to allow an adequate factor of safety for the normal range of operating pressures and yet provide for maximum economy in overall investment costs. Five cathodic protection rectifier units were installed soon after construction of the line was completed.

"The three principal methods used to examine the nine year old coating were:

1. A modified Pearson coating discontinuity survey.
2. Inspection of a representative number of indicated coating failures.
3. Coating conductance measurements on isolated sections of the gross structure.

Results. "This survey indicates that the inspection made of the coating during manufacture and construction of the line was of a high order.

"The rate of discontinuities was found to be one per four miles of pipe line. This exceedingly low rate substantiates the high quality of the coating found in the examination.

"The coating was almost completely unaffected by soil stress with the whitewash largely intact.

"The low discontinuity rate per mile and small area of affected coating shows that moderate protective voltages have not affected the sound coating for at least nine years.

"The total area of coating adversely affected from any cause whatsoever was approximately 50 square feet in over 3 million square feet of pipe coating."

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Pipeline Communications and Electronics

By FRANK CHAPMAN

Practical problems of microwave communication

Frank Chapman

SEVERAL practical day-to-day operational problems encountered in existing long distance microwave communication circuits were discussed recently by M. O. Sharpe, superintendent of communications for Trunkline Gas Co., at a symposium on microwave systems sponsored by the Southwest Research Institute in San Antonio, Tex. After briefly outlining some of the problems involved in the construction and initial operation of a microwave installation, Mr. Sharpe proceeded to detail some specific causes of circuit failure with which he has been intimately associated and, in each instance, to point out a practical remedy.

Speaking of circuit failures due to signal fading, he described periods of fading which lasted for several hours during which the circuit would be in service for only a few minutes at a time. Data taken on the five southern links of Trunkline's system between Barker, Tex., and Longville, La., showed that during the worst conditions there were 32-db fades for .135% of the time. With 6-ft diameter dish-type radiators, such as initially installed on this section of the circuit, a 20- to 22-db fade would make the circuit inoperative. Fades of this magnitude occurred about 2% of the time or 28.8 minutes out of a 24-hour day. However, with 10-ft diameter radiators, as presently installed on this section of the circuit, it is possible to maintain constant service. Although data taken on the circuit indicate 9-db fades for slightly over 10% of the time, they are not bad enough to be noticed by a person monitoring the circuit.

Mr. Sharpe pointed out that their tests indicate that the solution to the fading problem is in space-diversity reception. As an example he used a test line on the Trunkline circuit between Silsbee and Moss Hill, Tex., where, during a 44-day period, the combined output of two dishes was down 32-db only .01% of the time. In time out of service this amounts to only nine seconds per 24-hour day.

The upper dish, which showed 32-db fades for slightly over 0.1% of the time, was 10 ft in diameter and mounted on a 340-ft tower; and the lower dish, which showed 32-db fades for 0.125% of the time, was 6 ft in diameter and mounted 50-ft below the top dish. The test data were taken from Aug. 16 through Oct. 21, 1953.

Mr. Sharpe said that Trunkline is presently preparing for the installation of space diversity on six links between Barker, Tex., and Pitkin, La., as well as for the longest hop, of 39 miles, between Sumner and Longtown, Miss. The goal is the use of space diversity on every station along the line where a hop is as much as 20 miles in length.

A related operational problem pointed out by Mr. Sharpe was that of skip interference which, in a two-frequency system, is the situation where the fourth station in a chain receives not only the signal from the third station, which it is supposed to receive, but also the signal from the first station, which it is supposed not to receive. Trunkline has gone through its system alternating polarity of the dipoles in such a way as to eliminate all effects of skip interference.

A second problem indicated by Mr. Sharpe had to do with unstable transmitter frequency on the receiving side of a circuit break. The circuit break could be due to component failure, the failure of both commercial and emergency power or from a deep fade. In any of these instances, when the circuit fails the next station in line is designed to insert a pulse restorer which permits the remaining portion of the circuit to be used. In practice, however, Mr. Sharpe pointed out that when the circuit is interrupted and six or eight pulses are lost, the pulse restorer will often insert only a portion of the lost pulses.

He pointed out that the next-in-line transmitter may, under such circumstances, maintain its frequency, it may change its frequency slightly, or it may drift off frequency far enough to get outside the acceptance and of the following receiver. A slight frequency drift may go unnoticed for when the circuit is restored the transmitter automatically goes back on frequency. If the drift is more severe, however, intermittent noise may appear on the circuit and, if the drift is severe enough, a second circuit break will take place.

Mr. Sharpe also brought up the problem of heat in microwave equipment enclosures. High ambient temperatures, together with the heat developed by electronic equipment, have often resulted in temperatures as high as 130° during the summer months in buildings housing radio equipment. Trunkline has recently completed the installation of high velocity fans in 16 of its larger buildings and is in the process of making similar installations in all other buildings. With its method of installation it is pulling the air into the building through a 2-in. thickness of spun glass filter and exhausting it through a 12-in. diameter roof vent. In this manner an appreciable air pressure is built up within the building which results in a reasonably dust free enclosure if filters are replaced at proper intervals.

In microwave systems that have no standby radio equipment, it is imperative that some means be provided for indicating where a failure is located and, if possible, its cause. It is essential that the maintenance engineer in the district where the failure occurs be notified of the trouble as soon as possible. Alarm systems are often triggered by noise on the circuit, especially in connection with a circuit failure, which produces a false indication of circuit trouble. The Trunkline circuit makes use of two alarm channels with each one taking care of approximately one half of the total number of stations. Although the system will permit the receiving of simultaneous alarms on each channel, it will not receive more than one alarm on either channel at the same

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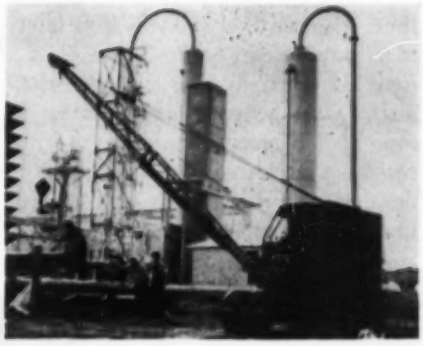

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time. Also, there is no method of interrogation that can be used in case of a jumbled alarm to give a repeat. Each alarm must be seen and recorded as soon as it is received so that the lamp panel can be cleared in readiness for the next alarm signal. Provision for automatically recording the alarm information would remedy this situation.

In closing his talk, Mr. Sharpe emphasized the importance of a good maintenance engineer. He pointed out that the engineer is the basis for a satisfactory system, regardless of what may be devised in the way of improved radio equipment.

Frequency assignment policy

According to the safety and special service bureau, the FCC has adopted the policy in the land-mobile safety and special radio services of "assigning the most suitable alternate frequency if the frequency requested for assignment is not, on the basis of the commission's records, the best which can be made when previous assignments in the area are considered." This policy applies only in those cases where the proposed assignment has not been endorsed by a recognized frequency advisory committee or is not in accordance with a recognized frequency assignment plan.

It is emphasized that this policy is only for the protection of applicants and licensees who are unable to take their problems to committee for resolution, and in no way relieves the applicant of the responsibility of endeavoring to select the most desirable frequency from the standpoint of causing the least practicable interference to existing radio operation.

Recent FCC authorizations

The following authorizations have been issued by the Federal Communications Commission in the petroleum radio service:

1. Gulf Interstate Gas Co., Houston, for 100 mobile units on 48.72 m.c.

2. Peoples Natural Gas Co., Pittsburgh, for one base station at Monongahela on 48.70 m.c.

3. Michigan-Wisconsin Pipeline Co., Detroit, for 150 mobile units on 48.90 m.c.

4. Manufacturers Light & Heat Co., Pittsburgh, for one base station at Grant on 33.38 m.c.

5. Texas Illinois Natural Gas Pipeline Co., Chicago, for one base station at Grand Tower on 33.30 m.c.

6. Transcontinental Gas Pipeline Corp., Houston, for one fixed unit at Decatur, Ga., on 953 m.c.

7. Ohio Fuel Gas Co., Columbus, for one base station on 33.38 m.c. at Ironton, Ohio.

8. Arkansas Louisiana Gas Co., Shreveport, La., for one base station on 30.82 m.c. at Waskom, Texas.

9. Lone Star Gas Co., Dallas, for one base station on 48.66 m.c. at Jacksboro, Texas.

Microwave meeting

The Microwave Frequency Coordinating Council, a group made up of representatives of each of the established radio services that is eligible for private microwave systems, will meet in Chicago on Feb. 24 at the headquarters of the Assn. of American Railroads. The meeting was officially announced in a letter of invitation to representatives of each of the industry groups which have an interest in private microwave systems. This letter explains that the council would not make frequency recommendations to the Federal Communications Commission, but rather would act as a clearing house for information on microwave systems. Up-to-date maps of existing systems and proposed systems would be maintained by the council, and such information would be furnished to prospective microwave users upon request.

Motorola appoints new communications head

J. P. Tansey

Daniel E. Noble, vice president in charge of Motorola's communications and electronics division, recently announced the appointment of John P. Tansey to the position of national service manager of that division. Mr. Tansey succeeds Fred Schnell, who has been designated staff assistant to the vice president. In the post of service manager, Mr. Tansey will direct Motorola's far-flung service organization which consists of over 700 authorized service stations throughout the United States.

Reallocation at spectrum above 890 m.c.

The Federal Communications Commission has adopted a notice of proposed rule making, designating Docket No. 10797, which looks toward amending Part II of the rules to reallocate the radio spectrum above 890 m.c. to meet existing service needs and foreseeable developments in the use of microwave by various fixed and mobile services. This proposal would continue to allocate the band 890 to 940 m.c. to the ISM (industrial, scientific, medical) services primarily, would allocate the band 890-936 m.c. to common carrier fixed service, with the provision that ISM interference be accepted; the 936-950 m.c. band would be allocated to AM, FM and TV (sound only) studio-transmitter stations subject to accepting ISM inteference between 936-940 m.c.; and the band 950-960 m.c. would be allocated to operational fixed stations. The presently shared mobile bands 3500-3700, 6425-6575 and 11700-12200 m.c. are also proposed to be divided equally for exclusive assignment to the domestic public services on the one hand and to the aviation, industrial, land, transportation, marine, and public safety services on the other. Comments in this docket must be filed on or before Feb. 15, 1954.

FCC annual report available

The 19th annual report of the Federal Communications Commission has recently been published and is available from the U. S. Government, Superintendent of Documents. The report contains a review of the highlights in the radio field for the fiscal year 1953 and, in addition, contains much statistical information regarding radio authorizations issued by the Commission.

For example, the report states that more than 235,000 authorizations were outstanding as of June 30 for the safety and special radio services, 5500 broadcast authorizations were oustanding at the same date and the remainder, totalling nearly 1.1 million authorizations, consisted of various other types of authorizations including operator permits. Approximately 600,000 transmitters were authorized as of June 30, 1953, and of these more than 430,000 were mobile units.

The report stated that the "largest group of radio stations comprise what is known as the safety and special radio services. The more than 235,000 authorizations for these 45 classes of non-broadcast services represent the use of nearly 152,000 land and fixed transmitters and 433,000 mobile transmitters." It was further stated that the "growing utilization of radio by industry is reflected in the nine types of service for which there are nearly 17,400 authorizations for use of 127,000 transmitters."

FCC plans regular domestic common carrier service

The commission has issued a notice of proposed rule making in Docket No. 10821 that proposes the adoption of a new Part 21 to the rules which will be entitled "Rules and Regulations Governing the Domestic Public Radio Services." The new part would establish a regular service for all domestic common carrier radio operations, other than maritime, aeronautical, and Alaskan point-to-point. This is accomplished by transferring from Part 6 to the new Part 21 the entire set of rules governing the domestic public land mobile services, expanding and revising these provisions in certain particulars and, in addition, setting forth new rules in Part 21 for regulating certain other domestic common carrier radio services heretofore treated as "experimental" services.

In a public notice relating to this pro-

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*V-10 is a 10 mil tape for average conditions, and

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ceeding, the commission has stated that "this proposal would make it possible to grant regular authorizations for such common carrier facilities as microwave radio relay, TV pickup, TV studio-transmitter link, rural subscriber, short haul toll, domestic control, domestic repeater, and developmental as well as permit conversion of presently outstanding experimental station authorizations for such facilities to regular service authorizations." The proposal, however, provides that any authorizations for facilities utilizing frequencies in the 72-76 m.c. band will be granted on condition that they be modified or terminated at any time without hearing if such would be required by the final order in Docket 10315.

FCC eases distributor-supplier communications

The Federal Communications Commission has finalized its rule-making proceeding in Docket No. 10709 by an order which amends the rules governing the industrial radio services so as to facilitate local coordination of communication activities between natural gas distributors and the pipeline companies which supply such gas. (See *GAS* for January 1954, page 112.) Specifically, the amendment provides for the assignment of frequencies allocated to the Petroleum Radio Service to stations in the Power Radio Service where a licensee engaged in distributing natural gas directly to customers has a substantial need to communicate with its gas supplier. In addition, use of Power Radio Service frequencies is permitted to stations in the Petroleum Radio Service where licensees in the former service are not also engaged in the operation of a natural gas distribution system. These rules changes became effective on Feb. 1, 1954. A copy of the complete order may be had upon request to Joseph E. Keller, special representative for the National Petroleum Radio Frequency Coordinating Assn., Munsey Bldg., Washington, D. C., or to the FCC.

FCC to survey land mobile radio services

The Federal Communications Commission, in cooperation with the Radio-Electronics-Television Manufacturers Assn., has recently distributed questionnaires to licensees in the public safety industrial and land transportation radio services in the District of Columbia area. This questionnaire is preparatory to the projected nation-wide survey of land mobile radio services. The form which was distributed in the Washington area was accompanied by a letter which indicated that the survey was being conducted "for the purpose of obtaining certain statistical information which will be summarized and used in making a determination of the actual frequency usage, the comparative saturation of frequencies in the various parts of the country, and the ratio of equipment authorized to equipment installed."

PIPELINE NEWS

Northeastern to be merged with Tennessee Gas

An application was filed last month with the FPC by Tennessee Gas Transmission Co., Houston, in which it seeks to acquire and operate the New England natural gas pipeline system of its wholly owned subsidiary, Northeastern Gas Transmission Co. It is believed that operational efficiencies would result from the merger and the enlarged Tennessee Gas system.

Among benefits to be derived by New England gas consumers would be several months' postponement of an increase in wholesale gas rates in New England. If maintained as a separate company, Northeastern immediately would file an application for a rate case, but this action has been delayed because of the merger application.

Details of the proposed merger included cancellation of Northeastern's $9 million in capital stock, all owned by Tennessee, together with cancellation of $8,915,700 in Northeastern Gas demand notes held by Tennessee.

All-Colorado line planned by Colorado-Western Gas

A newly formed gas company, Colorado-Western Gas Co., Denver, plans to construct a $35 million pipeline system to gather and distribute Colorado gas to some 18 state communities. The proposed line would extend 454 miles from the Ignacio gas fields in southwestern Colorado to Denver (see map), tapping other gas fields and serving areas en route.

Under terms of the petition filed with the state public utilities commission last month, Three States Natural Gas Co. would handle development of the reserves for Colorado-Western. Planning a wholesale business only, the new company proposes to supply "adequate quantities of natural gas to presently existing and incoming industries, commercial establishments, institutions, and municipalities." In Denver, the company would bring the gas to the southern city limits and turn it over there to Public Service Co., the distributing utility.

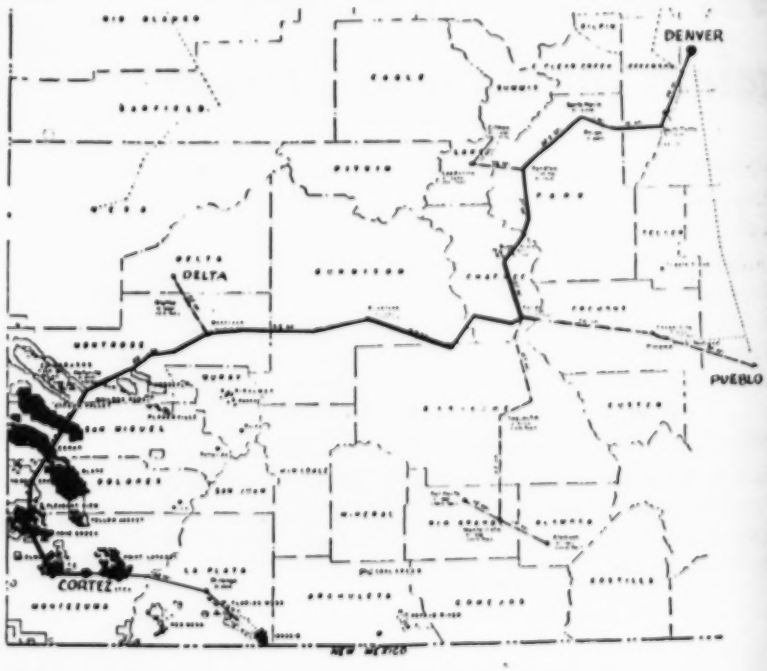
President of Colorado-Western is John A. McGuire of Dallas, who is also president of Three States. John R. Fell is vice president.

Panhandle has FPC's okay to abandon TGT service

An FPC presiding examiner has filed a decision, subject to review by the commission, approving a proposal by Panhandle Eastern Pipe Line Co., Kansas City, Mo., to abandon natural gas service which it renders to Texas Gas Transmission Corp., Owensboro, Ky., under a contract which expired last Aug. 31.

The decision, filed by Presiding Examiner Ewing G. Simpson, permits Panhandle to abandon the service effective two months from the date upon which the decision becomes final.

Examiner Simpson declared that the situation in which Texas Gas finds itself "is one of its own choosing and is in nowise based upon insufficiency of notice from Panhandle or upon any element of surprise." He said that Texas Gas is seeking to arbitrarily effect



Colorado-Western's line would extend 454 miles from Cortez in southwestern Colorado to Denver.

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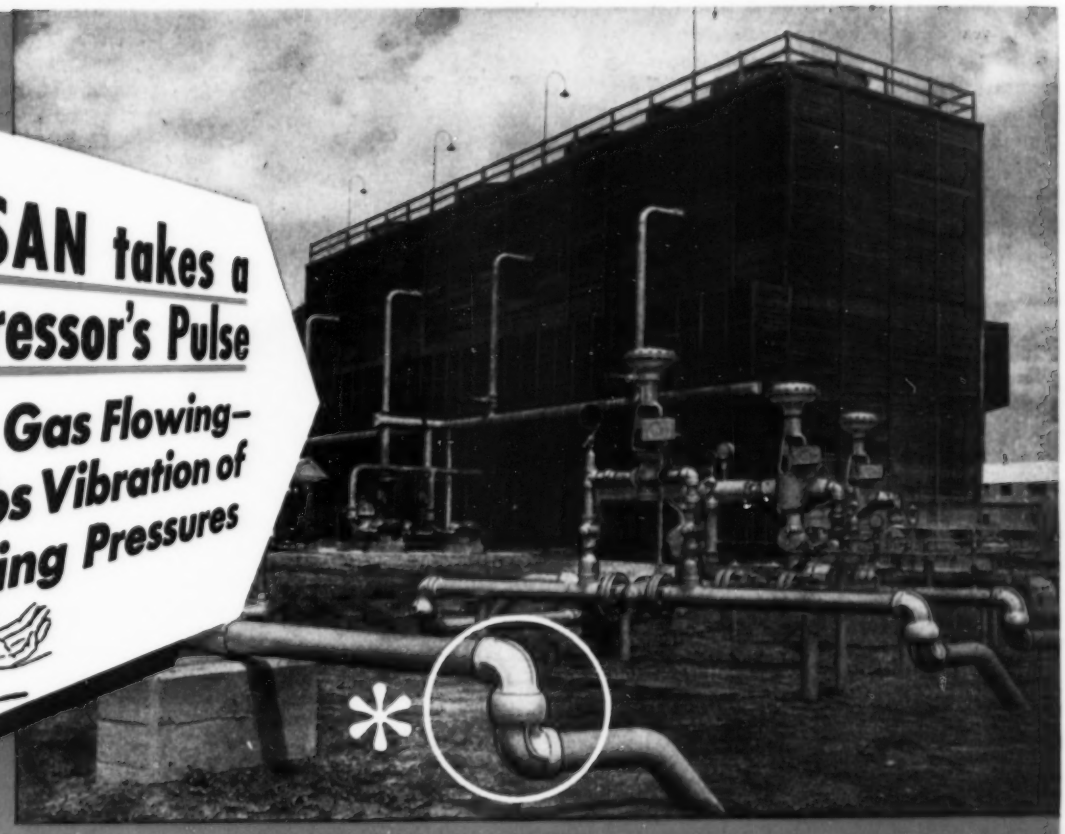

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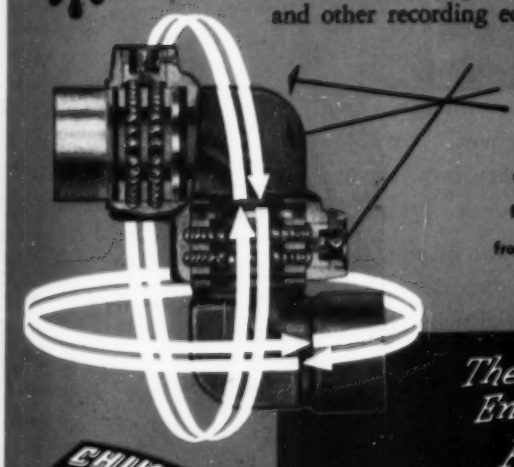

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"an indefinite, if not perpetual, extension of the 15-year term of its Panhandle contract on the basis of its own unilateral actions premised upon the apparent idea that Panhandle's giving of notice was a futile gesture from the beginning."

The contract, originally entered into by Panhandle and Kentucky Natural Gas Corp. (predecessor in interest to Texas Gas), requires Panhandle to deliver 18 MMcf of natural gas per day to Texas Gas at connections between the systems of the companies, deliveries being made near Danville and Montezuma, Ind.

Panhandle has contended that its ability to meet peak-load requirements of resale customers will be impaired if the termination is not permitted, and that Texas Gas can continue to meet its customers' requirements without the continuance of the service. Texas Gas, however, contends that it cannot replace the gas which would be lost by the abandonment, and that the plan would render useless the facilities constructed for the specific purpose of taking and using Panhandle gas.

National Cylinder Gas makes corporate changes

National Cylinder Gas Co. has simplified its corporate structure. Two of four wholly owned subsidiaries now operate as divisions and the corporate charters of the remaining two have been surrendered and their operations taken over by the parent company.

Tube Turns Inc., manufacturer of welding fittings and forgings, with headquarters in Louisville, Ky., has become the Tube Turns Div. Pennsylvania Forge Corp., Philadelphia, producer of flanges, rings and heavy forgings, has become a division known as Pennsylvania Forge Co. The Hollup Corp., Chicago, and National Cylinder Gas Co., Pacific coast, have been dissolved.

Charles J. Haines, president of National, said there would be no changes in the organization or method of operation of either Tube Turns or Pennsylvania Forge Co. "This streamlining of our corporate setup should be helpful in our expanded scope of operations," he stated.

Another new state—Nevada—joins the ranks of natural gas users this month as the Nevada Natural Gas Co., headed by President Harold G. Laub (at right), completes the laying of its 110-mile, 10-in. line to the Las Vegas area. Discussing the $2 million line with Mr. Laub are George Stevenson (left), manager of West Coast operations of American Meter Co., and R. H. Fulton, the contractor.

Tennessee Gas amends plan to move gas for Equitable

Tennessee Gas Transmission Co., Houston, has filed an amended application (Docket No. G-2316) with the FPC in connection with its proposal to transport natural gas for the account of Equitable Gas Co., Pittsburgh.

Originally, Tennessee proposed to increase the daily design delivery capacity of its pipeline system by about 24.4 MMcf of gas per day to enable it to transport the gas for Equitable. Under the new plan, however, TGT would utilize part of the unallocated design day sales capacity which it will have available upon completion of all its authorized construction.

The estimated $1,575,000 expenditure would cover the construction of about 50

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HOT DOPE

Straight from the Kettle on PIPE PROTECTION

★

By Boyd Mayes

● Used to be an Old timer named Josh who sat in a chair all day on the board floor in front of the general store in our home town. He'd tilt the chair back, close his eyes, and just rest all day. Josh saw more and rested more than anybody we ever knew. Somehow, just sitting still made all the folks think he was wise. He did pass out some pretty smart thoughts, at that. One time I asked him why he was always in such a good mood and he said: "Anybody who does his job well and likes what he is doing is happy. Take me for example. I just sit all day and rest—an' I enjoy it—but some folks can't even enjoy sittin' still."

We learned a lot from Josh, and we sure did find out that doing our own special job well makes for happiness—ours and our customers' too—and we feel mighty good when they come back time an' again to do business with us. We've been feeling that way now for more than 26 years—that's how long we've been cleaning, coating and wrapping pipe for folks in the pipe line industry.

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miles of 10-in. miscellaneous gas supply lateral line in Texas. Tennessee plans to receive gas on behalf of Equitable in Texas and to transport and deliver equivalent quantities to Equitable in Pennsylvania. The gas which would be transported has been purchased by Equitable in the Flour Bluff fields in Nueces county, Texas.

Tennessee proposes to transport up to 9.75 MMcf per day from Dec. 1, 1954 until Dec. 1, 1955; up to 19.5 MMcf daily from Dec. 1, 1955 until Dec. 1, 1956; and up to 24,375 Mcf per day from Dec. 1, 1956, until Dec. 1, 1974.

Colorado Interstate's new facilities cost 20 million

Officials of Colorado Interstate Gas Co. announced that new and additional facilities, constructed during the last six months of 1953 at an approximate cost of $20 million, now are in operation to serve the Rocky Mountain regional natural gas consumers.

The facilities provided by the construction program have added a total of 82.5 MMcf daily to the delivery capacity of Colorado Interstate, according to President W. E. Mueller.

The additional gas supply now enables the wholesale transmission company to meet the estimated peak-day requirements of its customers, Mr. Mueller stated. With the operation of the new and expanded facilities, Colorado Interstate Gas Co. now is capable of delivering in the Rocky Mountain region a total of 508 MMcf of natural gas daily.

Saskatchewan establishes production regulations

The first regulations to be established in Saskatchewan governing production allowables from the province's oil wells were announced by Hon. J. H. Brockelbank, Minister of Mineral Resources at Regina.

The new regulations set up under the oil and gas conservation act are printed in the Dec. 19 issue of the *Saskatchewan Gazette* (Vol. 49, No. 51.)

More gas for Midwest from Northern Natural lines

Northern Natural Gas Co., Omaha, has received FPC authorization to operate pipeline facilities which will make additional natural gas available this winter to customers serving market areas in the Midwest.

The commission, however, deferred action on that part of Northern's application pertaining to the construction of other facilities and the allocation of additional gas which will be available next winter, pending an oral argument which was scheduled for Jan. 28.

The commission's recent action authorizes Northern to operate first-year facilities, which include about 259 miles of 24- and 30-in. pipe and a total of 50,400 hp in compressor capacity, located in Texas, Oklahoma, Kansas, Nebraska, and Iowa. Estimated cost of construction is $33,273,000. The commission also granted a certificate for certain branch-line loops to enable Northern to deliver the additional gas during the current winter. Temporary authorization for this construction was granted last October. These facilities will increase the capacity of Northern's system by 200 MMcf per day, with the sales capacity increased by 186 MMcf daily.

The commission's order allocates a total of about 164 MMcf of gas per day, with each of Northern's customers, except Minneapolis Gas Co., receiving the amount requested for the 1953-54 winter. The Minneapolis company was allocated 235,315 Mcf instead of the $240 million it had requested.

The FPC's action still leaves approximately 114 MMcf of sales capacity to be allocated by further order, following the scheduled oral argument. Northern's second-year construction program, which has not yet been authorized, includes about 200 miles of pipe and 22,800 hp in compressor capacity at an estimated cost of $22,643,000.

Gas storage service plan proposed by Texas Eastern

Texas Eastern Transmission Corp. and a wholly owned subsidiary have filed an application with the FPC for approval of a plan that will see Texas Eastern Transmission Corp. store 12 billion cu ft of natural gas per year for Transcontinental Gas Pipe Line Corp., delivering the gas in the winter at a maximum rate of 133,500 Mcf of gas per day, and receiving redelivery from Transcontinental during the summer months.

Transco, of Houston, has agreements covering a 20-year period with seven of its customer companies in New York, New Jersey, and Philadelphia areas, providing for redelivery to such companies under identical terms as the Texas Eastern-Transco contract.

It is emphasized that these agreements will permit greater use by Texas Eastern of its interest in the Oakford storage pool and will make no new demands on Texas Eastern's gas supplies or reserves. Under the "gas storage service" plan, customer companies will purchase summer gas already contracted to them by Transcontinental under existing service agreements, and the customer companies will make that gas available for summer delivery into storage by Texas Eastern. In the wintertime that gas will be withdrawn from storage by Texas Eastern, delivered to Transco, and then delivered to the customer companies with maximum daily volumes as follows:

Public Service Electric & Gas Co., Newark, 66 MMcf; Philadelphia Electric Co., 30 MMcf; Brooklyn Union Gas, 22 MMcf; Elizabethtown (N. J.) Consolidated Gas Co., 7 MMcf; Philadelphia Gas Works, 5 MMcf; South Jersey Gas Co., 15 MMcf; Delaware Power & Light Co., Wilmington, 2 MMcf.

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subsidiary, Texas Eastern Penn-Jersey Transmission Corp. plans to construct and complete in time for operation this fall a new pipeline system at a total cost estimated at approximately $31 million. It will include 265 miles of 24-in. line extending from Oakford in western Pennsylvania to the parent company's compressor station near Lambertville, N. J. Also included in the application are plans for one 3,300-hp compressor station near Oakford and other installations and measuring stations on the system, all of which will be leased to, and operated by, Texas Eastern Transmission.

The applications also provide for increasing peak-day sales to Philadelphia Gas from 82 MMcf to 110,852 Mcf, and for increasing the quantities of gas deliverable on any day to the Manufacturers Light & Heat Co. and the Ohio Fuel Gas Co. from 59.2 MMcf to 100 MMcf.

Gas gathering tax decision from Supreme Court due

The Supreme Court heard concluding arguments Jan. 6 on the constitutionality of the Texas gas gathering tax. A decision was expected momentarily on the controversial million-dollar-a-month revenue measure, which has run a gauntlet of court tests brought by interstate pipeline companies since the tax was enacted nearly three years ago.

The tax, imposed on shippers of gas when they take possession at the entrance of their pipelines, was ruled an unconstitutional burden on interstate commerce by a Texas district court. That decision was later reversed by the Texas supreme court.

Michigan Wisconsin Pipe Line Co. and Panhandle Eastern Pipeline Co. are challenging the tax measure on behalf of 117 pipeline firms that buy gas in Texas for shipment to consumers in Texas and 38 other states.

Atlantic Seaboard now owns natural gas line

In a move to simplify the corporate setup of the Charleston Group companies of the Columbia Gas System, the Virginia Gas Transmission Corp. was dissolved on Jan. 1.

As a result, the Atlantic Seaboard Corp., subsidiary of Columbia Gas, has become the sole owner and operator of the 262-mile, 26-in. pipeline which runs from near Charleston, W. Va., to Rockville, Md., and the 421-mile, 20-in. pipeline extending from Boldman, Ky., to the Maryland-Pennsylvania state lines.

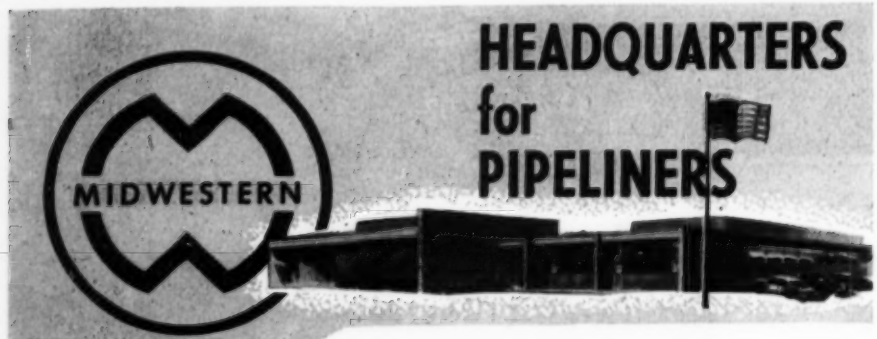
Transco rate case settled by compromise

The long-pending rate case of Transcontinental Gas Pipe Line Corp., which was originally filed on Sept. 17, 1952 and covering rates which have been in effect under bond since March 1953, has been settled by compromise. Transco is now permitted rate increases resulting in increased revenues of $7,611,936, based on sales of 191 billion cu ft for a 12-month period. Under the approved settlement, which marks the culmination of prolonged conferences between representatives of Transcontinental, the commission's staff, marketing companies, and state utility commissions, the permitted increase went into effect Dec. 1, 1953.

Under terms of the order, Transcontinental is required to refund to its firm customers approximately $1,563,141 with interest, representing amounts collected from March 18, 1953 through Nov. 30, 1953, the period that Transcontinental's former rates schedules were in effect under bond.

In other recent rate cases, the FPC set Feb. 15 as the date for resumed hearings on Southern Natural Gas Co.'s proposed $6,313,000 increase; postponed until Feb. 8 the hearing on El Paso Natural Gas Co.'s case involving a suspended $15,287,000 wholesale increase; and reconvenes hearings on Northern Natural's proposed $13,485,500 hike.

The FPC also rejected East Tennessee Natural Gas Co.'s proposed $426,417 increase and directed the company to file a new schedule for a $132,939 increase; suspended Amere Gas Utilities Co. $2237 increase i



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its gas price to Bluefield (W. Va.) Gas Co.; made effective as of Jan. 1 Texas Illinois Natural Gas Pipeline Co.'s $5,857,600 increase under bond and subject to possible refund; permitted Colorado-Wyoming Gas Co. to file a substitute rate of $336,000 for the $432,500 increase which has been under FPC suspension; consolidated two proceedings on a proposed change in the general service rate schedule of Alabama-Tennessee Natural Gas Co., Florence, Ala., with the hearing already scheduled for Feb. 24 on a proposed rate increase.

The FPC has also stayed, pending further order, its Nov. 19 order prescribing gas rates for United Fuel Gas Co. which would increase the company's revenues by about $1,340,000 annually over those allowed by the FPC in a decision issued last Aug. 7; planned to hear oral arguments on the Colorado Interstate Gas Co. request for a $6,508,000 increase, which went into effect under bond on Jan. 1; approved a proposed settlement under which United Natural Gas Co. will be allowed an increase in its wholesale rates of approximately $1,604,800 per year instead of the $1,749,430 originally proposed; and issued rulings in two rate proceedings involving Natural Gas Pipeline Co. of America in which it determined that two increases ($2.4 million and $3,511,489) proposed by the company for customers in Kansas, Nebraska, Iowa, Illinois, Indiana, and Wisconsin are justified. The first increase was in effect from 1951 to 1953, when it was superseded by the second. The commission's action allows the company to retain all of the money it has collected under bond in both proceedings.

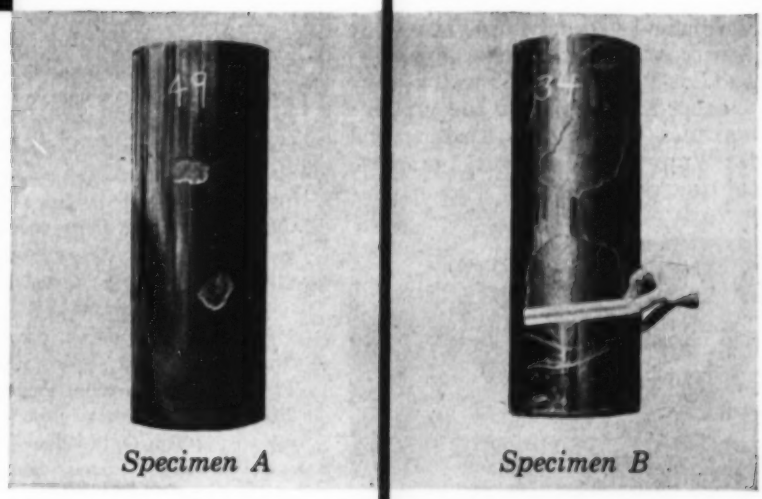
Louisiana-to-Michigan line among FPC applications

Four interdependent applications—including a proposal by American Louisiana Pipe Line Co., Detroit, to build a Louisiana-to-Michigan pipeline—requesting authority for the construction of natural gas transmission facilities have been filed with the FPC.

In addition to American Louisiana, the filing companies are Texas Gas Transmission Corp., Owensboro, Ky.; Michigan-Wisconsin Pipe Line Co., Detroit; and Michigan Consolidated Gas Co., also of Detroit. American Louisiana, Michigan-Wisconsin, and Michigan Consolidated are subsidiaries of the American Natural Gas Co.

American Louisiana, which is a newly formed company, is proposing to construct approximately 1289 miles of pipeline at an estimated cost of $130 million. The proposed system would include 30-in., 24-in., 22-in., 8-in., and 6-in. pipe and three compressor stations of 10,000 hp each. The 30-in. portion of the line would extend from North Tepetate, Acadia parish, La., to a point of connection with Michigan Consolidated's facilities near Detroit. The 22-in. portion of the system would extend from a point on American Louisiana's proposed 30-in. lines near Payne, Ohio, to a point of con-

BETTER BOND ON SPI C/W PIPE WITH STEEL-GRIT CLEANING



Specimen A *Specimen B*

Steel grit cleaning produces a better bond of the coating materials than any of the conventional methods of cleaning pipe, including wire brushing.

Both specimens of coated pipe, using the same coating materials, were tested according to A.S.T.M. Methods, and conclusively proved a better bond is secured by steel grit cleaning.

Specimen A . . . steel grit cleaned, produces a bright metal, roughened surface, illustrates the superior bond. *Specimen B* . . . power wire brushed produces a smooth and polished surface that does not have an equal bond.

Only at Standard Pipeprotection Inc., is every length of pipe cleaned with steel grit. Two Wheelabrators, one for ¾″ to 6″ and one for 6″ to 20″ pipe, clean your pipe for better bond.

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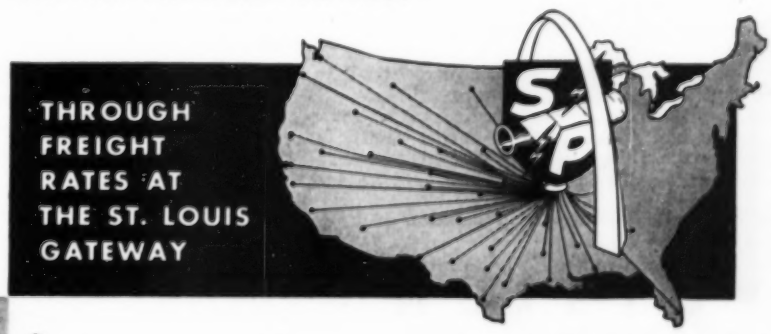

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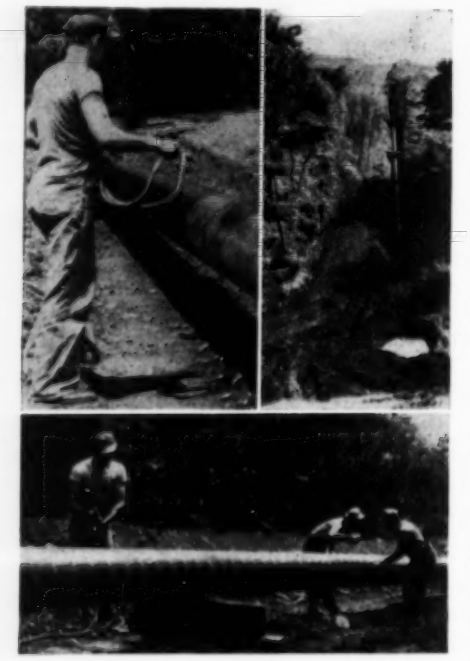

Upper Right—An Equitable Gas System 20" line through rough country. Upper Left—First coat of Roskote being sprayed on this line in the field, no primers needed. Bottom—The pipe is then wrapped with Royston Glas-Wrap and given a second coat of Roskote.

Not just the easy jobs for Roskote! It's tough enough to withstand the abrasion and corrosion of any soil, keeps its flexibility from -40° to 375°F. without brittleness or sag. Utility and pipeline companies know they can forget their corrosion worries when their pipe is "Roskoted". Roskote is applied cold, dries fast to save time and is non-toxic. It resists acids, alkalies and moisture—has an electrical resistivity of 20 megohms per square foot.

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nection with Michigan-Wisconsin's system near Bridgman, Mich. The 24-in. and the smaller size pipe will feed gas into the 30-in. line at North Tepetate.

American Louisiana proposes to purchase an average of 51 MMcf of gas per day from Texas Gas at a connection near Slaughters, Ky. The system would have an initial capacity of about 300 MMcf per day, with an average of 255.7 MMcf being purchased from various fields in southern Louisiana. The gas would be made available to all markets served by the American Natural Gas Co. system, which also includes the Milwaukee Gas Light Co.

Texas Gas wants to build about 48 miles of 26-in. pipeline, paralleling sections of the company's existing system between its Lake Cormorant, Miss., compressor station and its Slaughter, Ky., compressor station. The project also would include one additional 1500-hp compressor at Texas Gas' Covington, Ky., compressor station, and a sales meter station near Slaughter for the proposed sale of natural gas to American Louisiana. Estimated cost of the project is $4,281,135.

Michigan-Wisconsin is proposing to construct approximately 251.9 miles of 24-, 18-, 12-, 6-, and 4-in. pipeline loops and 3400 additional horsepower at existing compressor stations, principally in Illinois. The company is proposing to purchase about 100 MMcf of gas per day from American Louisiana. The new facilities have a total estimated cost of $11,435,000.

Michigan Consolidated plans to build facilities to operate the Six Lakes field in Mecosta and Montcalm counties, Mich., as a storage field. The construction includes a 32,000-hp compressor station in the field; a station located near Detroit to receive about 200 MMcf of gas per day from American Louisiana; and about 25.5 miles of 12-in. pipeline extending from a point of connection with Michigan-Wisconsin's facilities near Sparta, Mich., to Muskegon, Mich. Total estimated cost of Michigan Consolidated's project is $12,745,900.

Impressive gains predicted for pipelines and utilities

Sales of gas by utilities and pipelines in 1956 will total about 71.6 billion therms, an increase of 33.1% over actual sales of 53.8 billion therms in 1952, and 25.8% higher than estimated sales of 57 billion therms in 1953, an AGA report on "Gas Requirements and Supplies of the Gas Utility and Pipeline Industry" reveals.

The report covers estimates on an annual basis through 1956 as well as forecasts of peak day requirements and supply through the 1956-57 heating season.

Sales to interruptible industrial customers are expected to increase only slightly as the gas industry utilizes underground storage facilities more extensively in meeting peak load requirements imposed by househeating demands. Total withdrawals of natural gas from underground storage in 1956 will approach 4.4 billion therms, representing a gain of 110% over total withdrawals in 1952.

The increased use of underground storage in aiding pipelines to operate at high annual factors perhaps is one of the most significant developments shown in the survey.

The industry will require 7.3 million tons of steel pipe for its expansion program from 1953 through 1956. The major portion represents steel pipe of 16 in. and larger diameter, which will require 4.9 million tons or 67% of the total.

New construction costs are expected to aggregate $4 billion in the four-year period with an estimated $1.9 billion being expended for transmission facilities. About $1.4 billion will be spent on new distribution facilities with the remainder going for production, underground storage, and general plant expansion.

The report on which these statistics is based is essentially a continuation of a previous survey conducted by the gas planning division of the Petroleum Administration for Defense.

FPC allocates 64 MMcf of Transco's available gas

Part of the 64 MMcf of gas that Transcontinental Gas Pipe Line Corp., Houston, had available when it decided it could not deliver these volumes for resale in New England has been allocated by the FPC.

The recent commission order sends 47,047,000 cu ft out on a permanent firm basis and holds in reserve for future determination an additional 16,953,000. However, the latter amount has been allocated on a temporary firm basis to some of Transcontinental's customers.

Some of the same companies scheduled to receive temporary volumes now will be put on a permanent allocation after further hearings scheduled for Feb. 8.

Bulk of the 47 MMcf will go to Consolidated Edison Co. of New York, Brooklyn (N. Y.) Union Gas Co., and Delaware Power & Light Co., Wilmington.

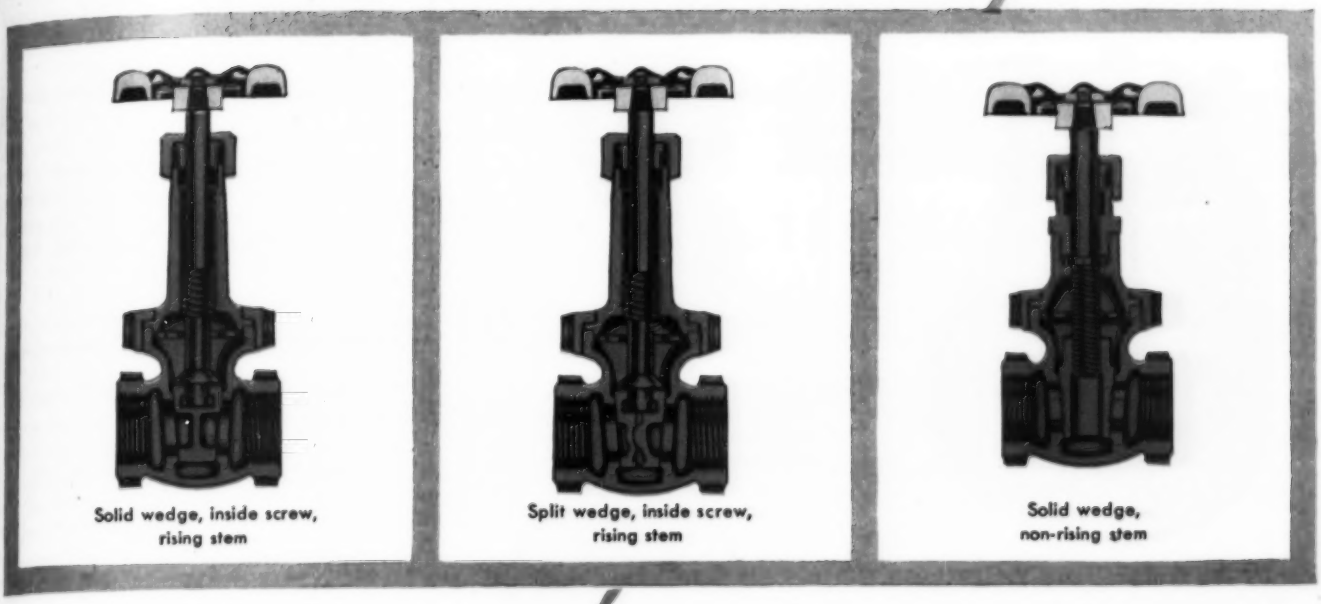
Big construction year planned by Tennessee Gas

Three inter-related applications involving an extension of the pipeline system of Tennessee Gas Transmission Co., Houston, and the construction of facilities for the underground storage of natural gas (see January *Gas*, page 116) have been filed with the FPC. (Docket Nos. G-2310, G-2330, and G-2331.)

In addition to Tennessee's application to expand its system, the proposals include joint applications by Tennessee and Iroquois Gas Corp., Buffalo, and by Tennessee and New York State Natural Gas Corp., Pittsburgh. The two joint applications involve the development of the underground gas storage facilities.

According to the FPC, Tennessee pro-

Oh, I see



Solid wedge, inside screw, rising stem

Split wedge, inside screw, rising stem

Solid wedge, non-rising stem

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Success of our 200 lb. line of union bonnet bronze gate valves necessitates expansion of the line to include 125 lb. and 150 lb. classes. Sizes range from ¼ to 2 inches.

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This line has a flat seat on the bonnet which mates against the body, providing adequate bearing area for sealing.

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Lug-type hexes make valves compact and provide a better wrench-gripping surface.

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150 lb. W. S. P. 400° F.

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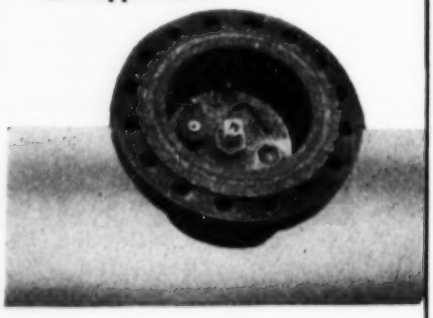
installed or removed under pressure without interruption of service . . . .

Plate in open position as in pipeline.

ORIFICE PLATE folded for insertion through tapping valve and tapped hole.



- Completed job with Orifice Plate open.
- Tapping Nipple plugged.
- Tapping Valve removed.
- Ready for blind flange.

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poses to build facilities estimated to cost about $33,677,000, to provide additional gas to existing customers and to serve new customers in New Jersey and the metropolitan New York City area.

The balance of Tennessee's 1954 construction program includes laying a 574-mile, 30-in. line from the Kinder, La. compressor station extending northeast through Louisiana, Mississippi, and Tennessee to join the existing pipeline system at the company's compressor station near Portland, Tenn. (Docket No. G-1969). Also included is the construction of two new compressor stations, one near Coudersport, Pa., adjoining the Hebron storage field, and the other near Findley Lake, N. Y., on the company's main pipeline to Buffalo. Five existing compressor stations will be enlarged. The program is scheduled to get under way on about June 1.

Notes

On Jan. 6, the FPC ordered Southern Natural Gas Co., Birmingham, Ala., to supply natural gas to the city of Villa Rica for distribution in Villa Rica and Fullerville, Ga. Villa Rica will construct a distribution system within the city and the adjacent town of Fullerville, and about 6.5 miles of pipe connecting with Southern Natural's system. It also will distribute gas along the right-of-way from Southern Natural's line to Villa Rica. Villa Rica estimates its requirements at 79,034,000 cu ft annually for the first year. Estimated cost of the facilities is $515,000.

The State Corporation Commission has approved the merger of Washington (D.C.) Gas Light Co. and the Rosslyn Gas Co. Rosslyn Gas, serving Alexandria, Falls Church, Arlington and Fairfax Counties, has been a wholly owned subsidiary of Washington Gas Light. The commission approved the merger upon the recommendation of the boards of directors of both firms.

The FPC has vacated the suspension of proposed contracts submitted last Sept. 28 by Colorado Interstate Gas Co. of Colorado Springs, covering natural gas sales to the Public Service Co. of Colorado, Denver, and the city of Colorado Springs for use in their electric power plants. Proposed contract changes are included with proceedings involving a suspended $6,508,000 annual rate increase proposed by Colorado Interstate.

Northern Natural Gas Co., Omaha, has asked the FPC authorization to acquire all of the natural gas facilities of its wholly owned subsidiary, Independent Natural Gas Co., also of Omaha. Independent's facilities are located in Gray and Carson counties, Texas, and include an 11,200-hp compressor station and about 21 miles of 20-in. pipeline. The subsidiary transports about 36 MMcf of gas per day, purchased from Phillips Petroleum Co. for sale to Northern, and also

transports for the account of Northern another 10 MMcf of gas daily which the parent company purchases from Phillips.

The Fort Smith Gas Corp., Fort Smith, Ark., has applied to the FPC for authority to acquire the natural gas facilities of Arkansas-Oklahoma Gas Co., also of Fort Smith. The application says the facilities of the two companies actually constitute a single integrated system, serving adjacent market areas in Arkansas and Oklahoma. The companies formerly were members of the same holding company system, and still share the same offices.

The FPC hearing previously scheduled to open Jan. 18 in Washington has been postponed until Mar. 29 in the proceedings on the application of South Georgia Natural Gas Co., Birmingham, Ala., proposing the construction of a natural gas transmission system to serve markets in Georgia and Florida.

Lone Star Gas Co., Dallas, has started construction of a 13-mile pipeline to tap the Gause gas pool in Milam county, southeast of Cameron. The 8-in. $212,000 line will have a capacity of 8 MMcf per day. The gas will be fed into the company's system furnishing fuel to some 30 central Texas towns.

With modifications, the FPC has affirmed a decision by an FPC presiding examiner authorizing Mid-Georgia Natural Gas Co., Atlanta, to construct and operate pipeline facilities to supply natural gas from the system of Transcontinental Gas Pipe Line Corp., Houston, to several communities in Georgia: Porterdale, Conyers, Millstead, Covington, and Oxford. Total estimated cost of Mid-Georgia's system is $1.1 million.

Progress Reports

NEW CONSTRUCTION PLANNED

AMERICAN LOUISIANA PIPE LINE CO., Detroit. Docket G-2306 to construct 1289 miles of line—30-in. from North Tepetate, Acadia parish, La., to connect with Michigan Consolidated facilities near Detroit; 24-in. to feed into 30-in. line in Louisiana; 22-in. to extend from Payne, Ohio, to Bridgman, Mich.; also, 3 10,000-hp compressor stations.

COLORADO WESTERN PIPELINE CO., Denver. To construct a 454-mile pipeline from Cortez to Denver, with 254 miles of laterals. To serve 18 communities.

MICHIGAN CONSOLIDATED GAS CO., Detroit. Docket G-2306 to build a 32,000-hp compressor station for storage in Six Lakes Field in Mecosta and Montcalm counties, Mich.; a compressor station near Detroit to receive gas from American Louisiana; and 25.5 miles of 12-in. line from connection with Michigan Wisconsin near Sparta to Muskegon, Mich.

MICHIGAN-WISCONSIN PIPE LINE CO., Detroit. Docket G-2306 for approximately 251.9 miles of 24-, 18-, 12-, 6-, and 4-in. loops and 3400 hp additional at existing compressor stations in Illinois.

PROOF

HERE'S HOW TAPECOAT® HAS STOOD THE TEST OF TIME TO SOLVE CORROSION PROBLEMS

PROOF (Underground) — Inspection of TAPECOATED joints after 10 years of underground service showed no sign of corrosion when the TAPECOAT was removed.

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PROOF (Above ground)—A gas line at a bridge crossing was TAPECOAT-protected in 1944. There has been no need for attention and *no interruption of service* since the pipe was TAPECOATED.

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TENNESSEE GAS TRANSMISSION CO., Houston. Dockets G-2310, G-2330 and G-2331 for 243-mile, 24-in. line from Hebron (Pa.) storage field to Greenwich, Conn., with 28-mile, 24-in. spur to New Jersey. Development of four more storage fields—Colden near Buffalo; Harrison and Ellisburg, both in Potter county, Pa., and State Line (N.Y.-Pa.).

TENNESSEE GAS TRANSMISSION CO., Houston. Docket G-2316 for 50 miles of 10-in. lateral lines in Texas.

TEXAS EASTERN PENN-JERSEY CORP., Shreveport. To construct 265 miles of 24-in. line from Oakford storage field (Pa.) to Texas Eastern Transmission Co.'s Lambertville, N. J. compressor station; a 3300-hp compressor station near storage field.

TEXAS GAS TRANSMISSION CORP., Owensboro, Ky. Docket G-2306 to build about 48 miles of 26-in. line between Lake Cormorant, Miss., and Slaughter, Ky. compressor stations; also one 1500-hp compressor station at Covington, Ky.

CURRENT CONSTRUCTION

EL PASO NATURAL GAS CO. Docket G-2106 for total of 1056 miles of line to include about 750 miles of 30-in. and 70 miles of 24-in. mainline with related gathering lines, purification facilities and compressor plants totaling 161,860 hp to carry gas from Permian and San Juan basins. Contractors are Oklahoma Construction Co., R. H. Fulton Co., Western Pipe Construction Inc. and company's own crews. All facilities to be in operation by November 1954.

EQUITABLE GAS CO., Pittsburgh. Docket G-2130 to activate the Logansport storage field in the Big Injun Sand, Marion county, W. Va. Installation of a 1320-hp compressor station in Wetzel county remains to be completed in the spring.

GULF INTERSTATE GAS CO., Houston. Docket G-2058 to construct 860 miles of 30-in. line from Rayne, La. to Boyd county, Ky., 229 miles lateral lines and five 8000-hp compressor stations in four states. Mainline contracts let to H. C. Price and Houston Contracting Co. Lateral line contracts let to Anderson Bros., Associated Pipe Line Contractors and Williams Bros. Parkhill Truck Co. hauling pipe. Expect completion Nov. 1, 1954. Over 600 miles of 30-in. line completed. Work under way on 313 miles of gathering lines.

NEVADA NATURAL GAS PIPE LINE CO., Las Vegas. Docket G-1888 for 110 miles of 10-in. line from Topock, Ariz. to Whitney, Nev., serving Las Vegas and Henderson areas. Contract let to R. H. Fulton Co., Lubbock, Texas. To be completed early in February.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket No. 2212 for 11 miles of 24-in. line to serve steam electric plant near Pittsburg. Scheduled for completion May 1.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-2102 to build about 220 miles of 34-in. mainline loops and 2500 hp in compressor capacity on line from Topock, Ariz. to a point near Milpitas, Calif.; and 6.5 miles of line between Milpitas and Irvington, Calif. Work begun by Engineers Ltd. Pipeline Co. south of Kettleman Hills. Completion of 88-mile Kettleman-Arvin section scheduled for April. Total job to be complete Nov. 1.

PERMIAN BASIN PIPELINE CO., Omaha. Docket G-1928 for 234 miles of line and 54,880 hp in compressor stations to carry gas from Upton, Midland, and Pecos counties, Texas and Lea county, N. M. to connection with 24-in. El Paso Natural line to Dumas, Texas. R. H. Fulton at work on mainline. Fluor Corp. Ltd., Dresser Engrg. Co. and Sterns-Roger Mfg. Co. on compressors. Compressors totaling 12,080 hp to be constructed in 1954. Remainder of project to be completed in February.

TEXAS EASTERN TRANSMISSION CORP., Shreveport. Docket G-2208 for a 4400-hp compressor station in Shelby county, Texas. Scheduled for completion in April by Brown & Root Co.

Pipeline People

Northern Natural Gas Producing Co.'s new district office in Wichita will be under the direction of L. B. FUGITT, who held a similar position in the now closed Amarillo office. Other personnel in the new office, which will supervise all exploratory and producing activities for the company in Oklahoma, Kansas, and part of Nebraska, includes R. V. MOORE, geologist, and B. J. PARKER, district land man.

M. M. FIDLAR, Mountain Fuel Supply Co.'s manager of exploration, has become vice president in charge of exploration, a new post created to coordinate the exploration division with the general office in Salt Lake City.

M. M. Fidlar
Mountain Fuel

R. R. Maddocks
Blaw-Knox

ROBERT R. MADDOCKS has joined the chemical plants division of Blaw-Knox Co., Tulsa, as chief process engineer.

Darling Valve & Manufacturing Co., Williamsport, Pa., has appointed M. STUART EVANS to the post of eastern regional sales manager with headquarters in New York, and JOSEPH T. COWAN as district representative in the Tulsa territory.

Colorado Interstate Gas Co., Colorado Springs, has promoted JOHN W. HOPKINS, formerly superintendent of compressor stations, to general superintendent and L. M. STONE from assistant controller to controller.

JOHN S. SHUTE, owner of the United Gas Corp. of Washington, has been elected president of Trans-Northwest Gas Inc., Spokane, succeeding PAUL H. GRAVES, who has become chairman of the board. Other new officers are BURL HAGADONE and JOSEPH DRUMHELLER, vice presidents, and K. J. SONNEY, general manager.

A. L. SPEARS is purchasing agent of the newly formed Mattoon Div. of Gar Wood Industries Inc., Mattoon, Ill. He had been staff assistant to the director of purchasing at Gar Wood's executive offices in Wayne, Mich.

ROY C. WILLIAMSON, vice president in charge of production, has succeeded C. T.

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CHENERY as president of Southern Production Co. Inc., Fort Worth. Mr. Chenery remains as chairman of the board.

FLOYD V. MARTIN, former plant superintendent at Pleasant Hill compressor station, is central division compressor superintendent of Panhandle Eastern Pipe Line Co., replacing CECIL CARTER, who resigned to become superintendent of compressor stations for Trunkline Gas Co.

DR. THOMAS K. SHERWOOD, professor of chemical engineering at MIT, has been retained by the Fluor Corp. Ltd., Los Angeles, as a consultant to its research and development division.

SAM A. SECKLER has been named an assistant manager of sales for the alloy steel division of Republic Steel Corp., Cleveland, succeeding CLYDE E. ROBERTS, who has become alloy steel division sales manager.

Obituaries

R. H. Hargrove

R. H. HARGROVE, 57, president of Texas Eastern Transmission Corp., was killed in an airplane crash in Louisiana on Jan. 10. His career in the gas industry began in 1928, when he became associated with the Palmer Corp., later a subsidiary of United Gas Corp. In 1929 he was elected vice president of Louisiana Gas & Fuel Co. and its subsidiaries, and in 1931 he became vice president of the United Gas Public Service Co., and subsequently held executive positions in the United Gas group.

In 1947 Mr. Hargrove became associated with Texas Eastern and in the same year became its president. He was a past president of the AGA, a director of the INGAA, and a member of the API, Mid-Continent Oil & Gas Assn., Southern Gas Assn., and Texas Mid-Continent Oil & Gas Assn. In addition, he helped organize the gas division of PAD and served as assistant deputy administrator in charge of gas matters in the initial establishment of the division. He had just been reappointed to the National Petroleum Council for 1954.

EDGAR TOBIN, of Edgar Tobin Aerial Surveys, was killed early in January in an airplane crash in Louisiana. A veteran of World War I, Mr. Tobin was a member of Eddie Rickenbacher's famed "hat-in-the-ring" squadron.

REGINALD HOUGHTON BURDICK, 69, consulting engineer of the Southern Natural Gas Corp., Birmingham, died recently. Mr. Burdick had retired as chief engineer and a vice president of the company.